



Standard of Care: Pelvic girdle pain

Physical Therapy management of the patient with pelvic girdle pain (also referred to as posterior pelvic pain), ante and post partum, as well as, the non-pregnant population.
Sacroiliac Joint Pain Syndromes in pregnancy.

ICD 9 code: 719.45-pelvic joint pain, 720.2- sacroilitis, 724.3- sciatica, and 846.9- sacroiliac sprain

Case Type / Diagnosis:

Pelvic girdle pain (PGP) is defined by pain experienced between the posterior iliac crest and the gluteal fold, particularly in the vicinity of the sacroiliac joints (SIJ).¹² PGP is a specific form of low back pain (LBP) that can occur separately or concurrently with LBP. The pain may radiate in the posterior thigh and can occur in conjunction with/or separately in the symphysis.^{1,2} PGP generally arises in relation to pregnancy, trauma, or reactive arthritis. The pain or functional disturbances in relation to PGP must be reproduced by specific clinical tests.¹²

The endurance capacity for standing, walking and sitting is diminished.² Studies have indicated that 47-49% of pregnant women experience some form of back pain during their pregnancy.^{3,4} PGP has an incidence of 20% in the pregnant population.² When a pregnant patient presents with back pain it is critical to differentiate whether the patient has PGP or lumbar pain as each condition require a different treatment approach. PGP does not present with sensory changes or weakness, which differentiates PGP from lumbar radiculopathy.⁴ Patients can have low back pain and PGP concurrently with an incidence of 8%.^{4,4} PGP may occur at any time during pregnancy, however, on average it begins in the 18th week of pregnancy.⁵

Albert described a classification system for pain based on location:

- **Pelvic girdle syndrome:** Daily pain in all three pelvic joints confirmed with positive pain provoked by the tests from the equivalent joints.
- **Symphysiolysis:** Daily pain in the pubic symphysis only, confirmed with positive pain provoked by the tests from the symphysis. Symphysiolysis does not imply an actual lysis.
- **One-sided sacroiliac syndrome:** Daily pain from one sacroiliac joint confirmed with positive pain provoked by the tests from either joints.
- **Double-sided sacroiliac syndrome:** Daily pain from both sacroiliac joints, confirmed with positive pain provoked by tests from both joints.⁶

The biomechanical cause of PGP is uncertain. Ostgaard states, "Posterior pelvic pain may be caused by a disturbance of the requested coordination of ligaments, muscles and joints in the posterior part of the pelvis. The problem is probably caused by the combined effect of the pregnancy hormones relaxin, estrogens and progesterone on the large ligaments in the posterior part of the pelvis. The result is an increased laxity, allowing a small but important instability in the pelvic joints."⁴ Studies have been done on women through their pregnancy up to 6 weeks post partum that examined the relationship between joint laxity, joint pain, and hormone levels. These studies found no significant differences between women who develop joint laxity and those who did not. Therefore, concluding that joint laxity is always the cause of pain is debatable.⁷ The effect of increased ligament laxity is a larger range of motion (ROM) in the pelvic joints. If this increased motion is not compensated for by altered neuromotor control, pain

Pelvic Girdle Pain

may be the result.² A relationship exists between asymmetric SIJ laxity and pelvic pain.¹ An SIJ with more texture and more ridges and depressions is hypothesized to be more stable since it has a higher friction coefficient. It would be reasonable to conclude that patients with decreased SIJ friction have an increased likelihood of instability at the SIJ. However, there is no linear relationship between pain and increased ROM in the pelvic joint, therefore it appears some women can handle increased laxity or ROM if adequate motion control or motor control is present.⁸

The role of the symphysis pubis in PGP is not clearly understood. Normally the symphysis pubis widens during pregnancy and is not considered clinically relevant. Ruptures of the symphysis pubis are defined as greater than one centimeter(cm), however 3-5cm separations can occur without symptoms, therefore separations are considered benign unless symptom producing.⁹ Post-partum symphysis pubis separation assessment and management are not within the scope of this standard of care. Please refer to the standard of care for post-partum symphysis pain and / or separation for a discussion of management. Symphyseal pain has a weak correlation to PGP, however, given the anatomy of the pelvis some studies have found strong correlations between symphysis pain and SIJ pain.^{3,10} Given that the pubis symphysis is a portion of the pelvic ring it is reasonable to consider that a dysfunction of the SIJ could affect the symphysis pubis and vice versa. It should be noted that patients might have separation without pain, and pain with or without instability.

A model of SIJ stabilization has been proposed by Vleeming, which considers the histology, anatomy and biomechanics of the joint. The biomechanics are described using the terms “form closure”, “force closure” and “self-locking mechanism”.¹

- **Form closure** is the idea that the shape and histology of the sacroiliac joint gives it stability. The sacrum is stabilized by the innominae because of its’ wedged shape, the cartilage in the joint is not smooth and there are bone extensions that protrude into the joint-ridges and grooves creating a stable situation where no extra forces are needed to maintain the system.¹
- **Force closure** is the idea that outside forces are needed to assist in stabilization, such as ligament and muscle forces that compress the joint, thereby increasing friction. This is critical to allow for movement of the sacrum during activities such as, walking, transferring, stair use, and bending. During any movement the SIJ needs to be stable for the pelvis to function normally.
- The combination of form and force closure is the “**self-bracing**” or “**self-locking mechanism**” of the SIJ. Form and force closure should be balanced. If a patient lacks form closure, perhaps because of genetics or anatomy, they will require more stability from muscles that assist in force closure. Someone with excellent form closure will have a stiffer sacroiliac joint and may be less susceptible to instability at the SIJ, and less susceptible to hormonal induced laxity in pregnancy.¹

Anatomically the force closing ligaments and muscles are as follows:

Force Closure Ligaments:⁸

- Interosseous and Short Dorsal Sacroiliac Ligaments- These ligaments are important during sacral nutation.
- The Sacrotuberous Ligaments – Because of their connection from the ischial tuberosity to the dorsal sacrum, they are influenced by muscle imbalances of the long head of the biceps femoris, gluteus maximus, and piriformis and from tension of the thoracolumbar fascia.

Pelvic Girdle Pain

- Long Dorsal Sacroiliac Ligaments- Connect between the dorsal surface of the sacrum and the posterior superior iliac spines.

Force Closure Muscles: ⁸

- Longitudinal Sling: Includes the multifidus muscles, the deep layer of the thoracolumbar fascia and the sacrotuberous ligament via the long head of the biceps femoris. Contraction of the spinal erectors can assist in force closure on the ipsilateral side or bilaterally if they are contracting bilaterally via the “pump it up phenomenon”. (Described below)

This sling provides stability by:

1) The contraction of the sacral part of the multifidus muscle thereby nutating the sacrum and increasing the tension of the interosseous and short dorsal SI ligaments.

2) The thoracolumbar fascia is inflated by the contraction of the multifidus muscles, which increases the tension on the fascia thus “pumping it up”, which in turn increases force closure.

- Posterior Sling: Includes the latissimus dorsi and the gluteus maximus.

This sling provides stability through a simultaneous contraction of the gluteus maximus and the contralateral latissimus dorsi. They act on the sacrotuberous ligaments thereby compressing the SIJ.

- Anterior Oblique Sling: Includes the external and internal oblique and the transverse abdominis.

This sling provides stability through a contraction of these muscles which compresses the entire pelvic girdle providing support/stability similar to an abdominal binder. The European guidelines for PGP proposed that joint stability is not merely about how much a joint is moving or how resistant structures are, but more about motion control that allows load to be transferred and movement to be smooth and effortless. Stability is effective joint control, which is the property that the joint returns to its initial position after perturbation.^{1,2}

Indications for treatment:

Increased pain

Impaired gait

Impaired functional mobility

Increased joint mobility

Impaired boney alignment

Impaired posture

Impaired muscle performance

Contraindications / Precautions for treatment: ¹¹

The following precautions/contraindications refer to patients who are currently pregnant:

- Deep heat modalities (ultrasound) and electrical stimulation
- Manual therapy techniques that may increase laxity
- Maintaining supine positions longer than three minutes after the fourth month of pregnancy

Pelvic Girdle Pain

The following precautions refer to any population with PGP:

- Positions which strain the pelvic floor and abdominal muscles which may aggravate symptoms
- Vigorous stretching of the hip adductor muscles
- The presence of Red Flags:

All patients with low back pain should be screened for “red flags” such as cord signs and cauda equina.

Examination: This section is intended to capture the most commonly used assessment tools for this case type/diagnosis. It is not intended to be either inclusive or exclusive of assessment tools.

Medical history: Often patients have a history of previous back pain and or trauma to the pelvis prior to pregnancy. There is conflicting evidence for multiples within a pregnancy (twins, etc. and a high workload as being risk factors for PGP. If a patient had PGP in a prior pregnancy there is a trend for it to occur in later pregnancies.^{1,2}

History of Present Illness: Aggravating factors a patient may report are:

- Pain with rolling over in bed.
- Prolonged walking or catching of the leg during gait, single limb stance or pain with advancement of the swing leg in the gait cycle.
- Prolonged sitting.
- Going up and down stairs.
- Lifting and twisting or asymmetrical loading of the pelvis.⁴
- Symptoms may ease with non-weight bearing positions such as hook lying or side lying with support.

Diagnostic Imaging:

Diagnostic imaging during pregnancy is unlikely. However, post-partum SIJ instability can be assessed radiographically via the Chamberlain technique, which is the gold standard for imaging pelvic ring instability. Pubic symphysis motion is measured while the patient stands on one leg.

- The European guidelines state that there is no evidence to support the use of conventional radiography or CT in diagnosing PGP.²
- The European guidelines recommendation is to use MRI for discriminating changes in and around the SIJ, early ankylosing spondylitis as well as those patients exhibiting red flag signs and when surgical intervention procedures are being considered.²

Social History: Patients’ occupational demands such as prolonged sitting, standing, lifting and bending are contributing factors that need to be addressed.

Medications: Non-steroidal anti-inflammatory medications are contraindicated during pregnancy. Tylenol may be used as an analgesic. Non pregnant patients will often be taking anti-inflammatory medications and may also undergo steroid injections

Observation:

Pelvic Girdle Pain

- **Gait-** Patients may have an antalgic gait. Increased pelvic mobility may be observed during gait. This may be appreciated by observing quantity of movement of the pelvis in both the sagittal and transverse planes.
- **Function-** Patients may have difficulty with transitional movement and may brace themselves with sit to stand transfers. Stepping up and down, crossing legs, and rolling from supine to side lying may also be provocative.
- **Posture/alignment-** Given the postural changes that occur during pregnancy, one might assume that they are a contributing factor, however, multiple studies have indicated this is not the case.^{12, 13} It is important for the therapist to consider the muscle imbalances that may occur because muscle pain can occur secondarily and become chronic once established. Patients may exhibit shifting and frequent changes of position while standing. Patients may favor weight bearing on one side, which may contribute to muscle imbalances between the gluteus medius (GM) and the Tensor Fascia Lata (TFL). The latter can create TFL tightness/overuse and a weak, inhibited GM.

Pain:

Pain will be located in the posterior pelvis distal and lateral to the lumbosacral junction. It may be described as stabbing and / or a catching sensation by the patient. It can radiate into the posterior thigh or knee, but not the calf or foot. The patient may or may not have pain at the symphysis pubis.^{3, 10}

Subjective outcome measures including the Oswestry Disability Index, a body diagram, and the numeric pain scale are reliable and valid measures to quantify changes in pain.¹⁴

Palpation: It has been suggested that the long dorsal SI ligament should not be overlooked in patients with PGP. A study with 394 women with PGP found that 42% indicated pain in the area of the long dorsal SI ligament.^{5, 15} Other ligaments, which attach to the sacrum may also be tender and should be assessed, i.e. the sacrotuberous ligament. Palpation of the symphysis pubis may also reveal tenderness and/or hyper mobility.

Neurological testing:

Sensation testing and reflexes should be tested and normal.

Muscle performance:

Muscle testing may be normal in patients with PGP, however muscle imbalances should be addressed if found during lower quarter screening. Pelvic floor muscles, transverse abdominis, the obliques, gluteus maximus, and gluteus medius may be found to be weak especially in patients with poor force closure. Hip adduction strength has been correlated with severity of PGP. Hip adduction strength is correlated as a predictor of prolonged disability.¹⁶ Rehabilitative ultrasound imaging (RUSI) can also be used to assess the timing and accuracy of transverse abdominis contraction to facilitate its correct timing during functional and strengthening activities.

Range of Motion testing:

It has been reported that patients should have full ROM of the hips and spine.¹⁷

Pelvic Girdle Pain

Clinical Special tests:

Tests that have been evaluated in pregnant women:

The tests with the highest sensitivity and specificity for the SIJ were the Posterior pelvic provocation test (P4), Patrick's Faber test and Menell's sign. Unless otherwise noted, in all the tests described below, localized pain provocation in the region of the SIJ and/or pubic symphysis is considered a positive test. Tests should be performed with the intent of provoking the least amount of pain and fewest position changes.⁶

- **Posterior pelvic pain provocation test (P4): posterior shear or thigh thrust test.**

This test has been shown to have high sensitivity of 90% and specificity of 98% in women with PGP.^{6, 18}

Method: The patient lies supine, one hip is flexed up to 90 degrees with the knee bent, and the other leg is straight. An anterior-posterior force is applied through the femur of the bent leg. The patient's pelvis is stabilized with the opposite hand on the superior anterior iliac spine. A positive test the patient will report pain deep in the gluteal area.

- **Patrick's Faber testing**

This test has been shown to have a sensitivity of 70% and specificity of 99%. **Method:** The patient lies supine: one leg is flexed, abducted, and externally rotated so that the heel rests on the opposite knee. The examiner presses gently on the superior aspect of the tested knee joint. If pain is felt in the SIJ or in the symphysis the test is positive.^{1, 2, 6}

- **Menell's sign**

This test has been shown to have a sensitivity of 70% and a specificity of 100%. The patient is supine. One leg is moved into 30 degrees abduction and 10 degrees flexion in the hip joint, and is first pushed into then pulled out from the pelvis, causing a sagittal movement.⁶

The tests with the highest sensitivity and specificity for the symphysis were palpation of the symphysis and the modified Trendelenburg tests.⁶²

- **Palpation of the pubic symphysis**

The patient is supine. The entire front side of the pubic symphysis is palpated gently. If the palpation causes pain that persists more than 5sec. after removal of the examiner's hand it is recorded as pain. If the pain disappears within 5 sec. it is recorded as tenderness.^{2, 6}

- **Trendelenburg Test:**

The patient stands on one leg, and flexes the opposite leg to 90 degrees (hip and knee). The test is considered positive if the hip is descending on the flexed side. If the pain is experienced in the pelvic joints, the test becomes a test for classification.^{1, 6}

- **Tests that have been evaluated in post partum women :Active straight leg raise (ASLR) testing:**

This test has been shown to have a high reliability, sensitivity of 87%, and specificity of 94% in women with PGP.¹⁹ Impairments in the ASLR have strongly correlated with increased mobility of the pelvic joint.²⁰

Method 1: Patients lie in supine with legs 20cm apart. The patient is instructed to "try to raise your legs, one then the other, 20cm in the air without bending the knee". The patient is asked to score the impairment on a 6 point scale ranging from 0-minimally difficult to 6-unable to perform.¹⁹ A variation of this test can be used to assess for the need for a pelvic belt.

Method 2: The patient performs the ASLR as above then the therapist applies a compressive force through the innominates and asks the patient if it's easier to lift the leg with or without the

Pelvic Girdle Pain

compressive force. A patient with PGP should report it is easier to lift the leg with a compressive force applied through the innominates. Another variation of this test can be used to assess for force closure issues of the anterior oblique sling.

Method 3: The patient is asked to flex and rotate the trunk towards the leg that is being raised. The therapist then applies resistance to the rotation and flexion through the patients shoulder as the patient raises their leg. If the patient reports it is easier to lift the leg with this test, it may indicate that her force closure is compromised and she may benefit from abdominal strengthening.

- **Cluster testing:**

Many studies have advocated the use of clusters of test for accurate diagnosis for SIJ pain. In general, tests that rely on palpatory findings verses pain provocation have lower reliability and specificity. The examiner should look for a “cluster” of tests to be positive rather than rely on a single positive test as diagnostic.

Cibulka and Koldehoff used four palpatory tests: the standing flexion test(Gillet’s test), sitting posterior superior iliac spine palpation, supine long-sitting test and prone knee flexion test. They reported a sensitivity of .82 and a specificity of .88 for a cluster of SIJ tests when three of four were reported positive.^{2, 21} When assessed individually these tests have low kappa values from .19 to .37 and should not be used clinically in isolation.²

Validity for the above tests does not exist because there is no established “gold standard”. Anesthetic blocks to the SIJ are only effective for intra articular pathology and should not be considered a gold standard for potential extra- articular structures.²

Joint play assessment:

Given the relaxation of the ligaments associated with pregnancy and the release of relaxin, mobilization of the pelvis or sacrum may reveal hyper mobility with both passive physiological testing and accessory movements. The end feel is likely to be soft with a small amount of resistance. Passive physiological testing may include anterior and posterior rotation of the innominates and possibly of the lumbar spines. Accessory testing should include anterior to posterior glides (AP’s) on the ASIS and Posterior to anterior glides (PA’s) of the lumbar spinous processes and sacrum to assess quality of movement and symptom reproduction, particularly in the non-pregnant population.

Differential Diagnosis: (if applicable): ¹¹

- Lumbar source of pain: A history of lumbar pain, pain located above the sacrum, decreased ROM in the lumbar spine and pain with lumbar motion, pain with palpation of erector spinae muscles and negative PGP special testing.
- Rupture of the symphysis pubis: Separations greater than 1 cm are considered to be symptom producing. Ruptures are characterized by tenderness, and possible swelling over the symphysis pubis. Gapping of the joint may be palpable. Patients may report difficulty with ambulation. Patients may have PGP in addition to rupture.⁹
- Diastasis recti: greater than two finger widths is considered abnormal. Measurements are taken 5cm above, at, and 5cm below the umbilicus.
- Gynecological and/or urological disorders
- Tumor of Infectious process

Pelvic Girdle Pain

Assessment/evaluation:

Establish Diagnosis and Need for Skilled Services

Problem List:

- Increased pain
- Impaired functional mobility
- Impaired ROM
- Impaired posture
- Impaired muscle performance
- Impaired knowledge
- Impaired joint mobility

Prognosis:

Generally, the prognosis is good in the postpartum population- the majority of women have resolution of pain within three months of delivery, with the prevalence of PGP declining to 7%.^{4,10} Some explanations why chronic PGP can develop are:

- Significant muscle imbalances
- Poor tissue quality and healing
- Underlying psychosocial issues
- Joint dysfunctions (hyper mobility/ instability/hypo mobility)

Goals: (Measurable parameters and specific timelines to be included on evaluation form)

- Patient will be independent with self- correction of postures, positions that minimize pain in 2 visits.
- Patient will demonstrate safe lifting and bending and body mechanic techniques that minimize pain in 2-3 visits.
- Patient will be independent with home exercise techniques in 1-2 visits.
- Patient will be independent with correct donning/use and indications for SIJ belt in 1-2 visits.
- Patient will be able to self-correct positional faults in 4-6 visits.
- Patient will minimize muscle weakness and increase flexibility in 6-8 visits or in the pregnant population as the pregnancy state allows.
- Patient will minimize antalgic gait with SIJ belt and or assistive device as needed in 1-2 visits.

Treatment Planning / Interventions:

Established Pathway ___ Yes, see attached. X No

Established Protocol ___ Yes, see attached. X No

Interventions most commonly used for this case type/diagnosis: This section is intended to capture the most commonly used interventions for this case type/diagnosis. It is not intended to be either inclusive or exclusive of appropriate interventions. There is controversy and debate in the literature as to if PGP can be “cured” during pregnancy. Ostgaard states “there is no cure for PGP while pregnant. The challenge is to teach these women how to live with a pelvis that is

Pelvic Girdle Pain

insufficient to serve as the stable center of normal body motion... it is possible to increase stability in the pelvis by muscular force, but only for a limited time.”¹⁵ Occasionally, vigorous exercise can increase these patients’ pain, due to muscle fatigue and the loss of force closure, which may cause the pelvis to become unstable again. Ligament insufficiency cannot be overcome by exercise according to Ostgaard. Others have suggested education and pelvic belt use are the only effective interventions for PGP and exercise has little to no effect on PGP.^{22, 23}

Pelvic belts:

Non-elastic pelvic belts have been shown to be effective in the majority of women with PGP.⁴ One cadaver study showed a significant decrease in sagittal rotation in the SIJ with the application of an SI belt.¹⁷ If a patient has an improved ASLR with application of a compressive force through the innominates, a pelvic belt should be used.

Therapeutic exercise:¹⁷

If the patient demonstrates poor force closure with the ASLR, the patient will likely benefit from a program targeting the abdominals. It has been shown that the transverse abdominis (TA) helps to stabilize the SI joint in healthy individuals.²⁴ If the patient has pain with transitional movements, training of the TA with these activities may minimize pain. If the patient is still pregnant, these techniques may or may not be successful, given that the TA will be lengthened considerably. Exercises for pregnant women should be done in an upright, semi-reclined position, or a position which reduces compression of the vena cava. The patient may have other muscle imbalances that should be addressed with exercise such as: shortened hamstrings, shortened piriformis, shortened gastrocnemius /soleus complex or weak gluteals. It should be noted if the patient’s symptoms worsen during exercise, attempts to strengthen should be ceased until post-partum (see precaution section). If the patient has persistent PGP post-partum, and demonstrates compromised force closure it would be appropriate to include a more vigorous training of the abdominals and pelvic stabilizers at that time.

The European guidelines recommend the use of an individualized treatment program focusing on specific stabilization exercises as part of a multi-factorial treatment for PGP post-partum²⁵²

Muscle energy techniques (MET):

MET techniques should be directed pelvic and sacral positional at faults.

Joint mobilization:¹⁸

Manual therapy has been shown to be beneficial in case reports.

Modalities:

Ice is the safest modality. Deep heat modalities and electric stimulation are contraindicated during pregnancy.

Education:

Education is the most important part of the management of PGP patients. The patient should be educated regarding the basic nature of this condition. The patient should minimize stairs, unilateral standing, asymmetrical sitting positions (i.e. Sitting with legs crossed), and end ROM of the hips and back. Patients should change positions frequently. A discussion of relevant ergonomics should be conducted, including work and home activities of daily living as well as

Pelvic Girdle Pain

post-partum care of her newborn. Although studies regarding posture suggest that postural changes are not the source of pain for women with PGP, proper posture is still worthy of consideration in patients with PGP.

Frequency & Duration:

Hall et al. demonstrated improvements in two case reports in as little as 5-7 visits over a two month time frame, in patients who were pregnant.¹⁸

Stuge et al. demonstrated improvements in a randomized control trial in 10 visits over twenty weeks (five months) in post partum patients.²⁵

Patients who are pregnant should have a minimum of 2-4 visits to ensure proper education and knowledge of treatment interventions. Post-partum patients will likely be treated for a longer period of time to allow for muscle performance to improve and at a higher frequency if pain management modalities are used; 2-3 times per week for 3-4 months post-partum.

Recommendations and referrals to other providers:

- Obstetrical and Gynecological Physicians
- Primary Care Physicians
- Post partum- pain management-Rheumatologist, Anesthesiologist vs. Physiatrist specializing in intra-articular injections.
- Acupuncture

Re-evaluation / assessment:

Standard Time Frame:

Re-evaluation is every 30 days or sooner if a status change occurs.

Other Possible Triggers:

Acute changes in signs or symptoms, or new trauma should trigger a referral back to the referring physician.

Discharge Planning:

Commonly expected outcomes at discharge:

As stated above, if patients are seen during pregnancy there is less of a chance for complete resolution of symptoms. Goals for therapy address activity modification and bracing as needed to minimize pain, promotion of functional mobility, and performing work tasks while pregnant. If symptoms continue post-partum, patients should be re-referred to physical therapy to attempt a stabilization program.

Transfer of Care:

Consider referral to aqua therapy, and acupuncture during pregnancy. Consider referral for intra-articular SIJ injections under fluoroscopy post-partum, however, pain is often from extra-articular sources. Patients may also be referred for surgical consideration for SIJ fusion in the setting of severe instability, and failed conservative management.

Patient's discharge instructions:

Patients discharge should be independent with donning and doffing the SIJ belt, independent with activity modification and postures to minimize pain. Patients should also be independent with exercise precautions and contraindications for exercise during pregnancy. Patients should

Pelvic Girdle Pain

follow up with their physician if symptoms progress or re-occur. Patients should understand physical therapy post-partum might be effective if their symptoms do not spontaneously resolve post-partum.

Authors:

Amy Butler, PT
Ethan Jerome, PT
11/05

Updated:

Amy Butler, PT
10/10

Reviewed by:

Meghan Markowski, PT
Sharon Alzner, PT

References:

1. Vlemming A, Albert H, Ostgaard H, Stuge B, Stuesson B. European Guidelines on the Diagnosis and Treatment of Pelvic Girdle Pain. . ; WG4 pelvic girdle pain: 1-50.
2. Vleeming A, Albert HB, Östgaard HC, Stuesson B, Stuge B. European guidelines for the diagnosis and treatment of pelvic girdle pain. *European Spine Journal*. 2008; 17(6):794-819.
3. Ostgaard HC, AndersonGB, Karlsson K. Prevalence of back pain in pregnancy. *Spine*. 1991; 16(5):549-552.
4. Ostgaard HC, Zetherstrom G, Roos-Hansson E, Svanberg B. Reduction of back and posterior pelvic pain in pregnancy. *Spine*. 1994; 19(8):894-900.
5. Vleeming A, Pool-Goudzwaard AL, Hammudoghlu D, Stoeckart R, Snijders CJ, Mens JM. The function of the long dorsal sacroiliac ligament: its implication for understanding low back pain. *Spine*. 1996; 21(5):556-562.
6. Albert H, Godskesen M, Westergaard J. Evaluation of clinical tests used in classification procedures in pregnancy-related pelvic joint pain. *European Spine Journal*. 2000; 9(2):161-166.
7. Kristiansson P, Svardsudd K, Von Schoultz B. Back pain during pregnancy: a prospective study. *Spine*. 1996; 21(6):702-709.
8. Vleeming A, Mooney V, Dorman T, Snijders C, Stoeckart R. *Movement Stability and Low Back Pain: The essential role of the pelvis*. 2nd ed. New York: Churchill Livingstone; 1997.

Pelvic Girdle Pain

9. Callahan JT. Separation of the symphysis pubis. *American Journal of Obstetrics and Gynecology*. 1953; 66(2):281-293.
10. Ostgaard HC, Roos-Hansson E, Zetherstrom G. Regression of back and posterior pelvic pain after pregnancy. *Spine*. 1996; 21(23):2777-2780.
11. Placzek, Jeffrey D., MD, PT, Boyce D, A. Orthopedic Physical Therapy Secrets. In: Philadelphia: Hanley and Belfus Inc.; 2001 .:166-167-377-384.
12. Franklin ME, Conner-Kerr T. An analysis of posture and back pain in the first and third trimesters of pregnancy. *J Orthop Sports Phys Ther*. 1998; 28(3):133-138.
13. Bullock, J, Jull G, Bullock M. The relationship of low back pain to Postural changes during Pregnancy. *Australian Journal Of Physiotherapy*. 1987; 33:10-17.
14. Kopec JA, Esdaile JM. Functional disability scales for back pain. *Spine*. 1995;20(17):1943-1949.
15. Vleeming A, de Vries HJ, Mens JM, Van Wingerden JP. Possible role of the long dorsal sacroiliac ligament in women with peripartum pelvic pain. *Acta Obstet Gynecol Scand*. 2002; 81(5):430-436.
16. Mens JM, Vleeming A, Snijders CJ, Ronchetti I, Stam HJ. Reliability and validity of hip adduction strength to measure disease severity in posterior pelvic pain since pregnancy. *Spine*. 2002; 27(15):1674-1679.

Pelvic Girdle Pain

17. Vleeming A, Buyruk HM, Stoeckart R, Karamursel S, Snijders CJ. An integrated therapy for peripartum pelvic instability: a study of the biomechanical effects of pelvic belts. *Am J Obstet Gynecol.* 1992;166(4):1243-1247.
18. Hall J, Cleland JA, Palmer JA. The Effects of Manual Therapy and Therapeutic Exercise on Peripartum Posterior Pelvic Pain: Two Case Reports. *The Journal of Manual and Manipulative Therapy.* 2005; 13(2):94-102.
19. Mens JM, Vleeming A, Snijders CJ, Koes BW, Stam HJ. Reliability and validity of the active straight leg raise test in posterior pelvic pain since pregnancy. *Spine.* 2001; 26(10):1167-1171.
20. Mens JM, Vleeming A, Snijders CJ, Stam HJ, Ginai AZ. The active straight leg raising test and mobility of the pelvic joints. *Eur Spine J.* 1999; 8(6):468-473.
21. Cibulka MT, Koldehoff R. Clinical usefulness of a cluster of sacroiliac joint tests in patients with and without low back pain. *J Orthop Sports Phys Ther.* 1999; 29(2):83-9; discussion 90-2.
22. Mens JM, Snijders CJ, Stam HJ. Diagonal trunk muscle exercises in peripartum pelvic pain: a randomized clinical trial. *Phys Ther.* 2000;80(12):1164-1173.
23. Nilsson-Wikmar L, Holm K, Oijerstedt R, Harms-Ringdahl K. Effect of three different physical therapy treatments on pain and activity in pregnant women with pelvic girdle pain: a randomized clinical trial with 3, 6, and 12 months follow-up postpartum. *Spine.* 2005; 30(8):850-856.
24. Richardson CA, Snijders CJ, Hides JA, Damen L, Pas MS, Storm J. The relation between the transversus abdominis muscles, sacroiliac joint mechanics, and low back pain. *Spine.* 2002; 27(4):399-405.

Pelvic Girdle Pain

25. Stuge B, Laerum E, Kirkesola G, Vollestad N. The efficacy of a treatment program focusing on specific stabilizing exercises for pelvic girdle pain after pregnancy: a randomized controlled trial. *Spine*. 2004; 29(4):351-359.