

Pregnancy-Related Lumbopelvic Pain

Introduction:

Pregnancy-related lumbopelvic pain involves either low back pain, pelvic girdle pain, or a combination of the two. Pregnancy-related lumbopelvic pain is the most common musculoskeletal complaint experienced during female pregnancy.¹ There, unfortunately, is a huge variance in the reported rate of lumbopelvic pain experienced during pregnancy due to differences in the population studied and study design.² Due to the inconsistencies in research related to pregnancy-related lumbopelvic pain, the prevalence of this condition is estimated to range between 24 to 90%.³ More specifically, it is estimated that more than 50% of pregnant females experience low back pain and between 10 and 65% experience pelvic girdle pain.¹ More often than not, individuals who experience pain during pregnancy will continue to experience symptoms for a prolonged period following delivery. For instance, a study found that about half of females with initial pregnancy-related low back pain will continue to experience pain one year postpartum, and 20% are symptomatic three years following delivery.⁴ Another study reported that postpartum pain at three months and three years is estimated to occur at a rate of over 40% and 23%, respectively.⁵ Pregnancy-related low back pain typically begins within the second trimester or around 22 weeks of pregnancy.⁴ Pregnancy-related pelvic girdle pain typically begins by the first trimester and peaks between the 24th and 36th week of pregnancy.⁴ Pregnancy-related pelvic girdle pain usually resolves spontaneously within six-months postpartum but eight to 10% will experience persistent pain for up to two years postpartum.⁴ Pregnancy-related lumbopelvic pain is considered to be chronic when the presence of pain within the lumbar or pelvic region is experienced for more than six months.⁶ Since there is little difference in the function and long-term prognosis in those reporting either pregnancy-related pelvic or low back pain, for this paper we will be discussing pregnancy-related lumbopelvic pain with an

assumption that this term encompasses those with low back pain, pelvic pain, and a combination of the two.⁵

Due to inconsistencies within research related to the prevalence and definition of pregnancy-related lumbopelvic pain, many of these individuals do not receive adequate care from health care providers. For instance, many females have reported feeling disappointed in the care and attention they received from health care professions when consulting about their pregnancy-related lumbopelvic pain.⁵ More specifically, they shared that a lot of professionals were dismissive of their symptoms and seemed uninterested in their concerns.⁵ Instead, it appeared that providers were more interested in other medical needs such as hypertension and less interested in their pain experience.⁵ Unsurprisingly, inadequate education is often cited as a reason why health professionals are dismissive of pain symptoms.⁵ With staggeringly high estimates for the rate of pregnancy-related lumbopelvic pain, and current reports of inadequate care, physical therapists have a responsibility to better serve this patient population through informed, evidence-based, and empathetic care. Therefore, this paper seeks to inform physical therapists about the anatomical contributions, speculated etiology, typical patient presentation, suggested examination approach, and evidence-based treatment options for pregnancy-related lumbopelvic pain.

Anatomy:

The pelvis is formed by the paired innominate bones, sacrum, and coccyx.⁷ The pelvis is supported by a mesh-network of strong ligaments that help make up the anterior and lateral walls of the pelvis visualized in Figures 1 and 2 of Appendix A.⁷ The iliolumbar ligament stabilizes, strengthens, and restricts rotational movement at the lumbosacral joint.⁸ This ligament starts at the top of the transverse process of the fifth lumbar vertebrae and attaches to the posterior part of

the iliac crest.⁸ The anterior sacroiliac ligament connects the lateral sacrum to the ilium.⁸ The sacrotuberous ligament runs from the sacrum and coccyx to the ischial tuberosity.⁸ The sacrospinous ligament runs from the ischial spine to the lateral sacrum and coccyx.⁸ Other ligaments include the sacrococcygeal ligaments, pubic symphysis ligaments, and endopelvic fascia ligament.⁸ In the female pelvis there are also ligaments within the reproductive system that support the internal genitalia which are divided into three categories: broad ligament, ligaments related to the ovary, and ligaments related to the uterus.⁸ The ligaments specific to the female reproductive system can be seen in Figure 3 of Appendix A. The broad ligament extends from the lateral sidewalls of the pelvis to the uterus at midline.⁸ This ligament covers the fallopian tubes and ovaries anteriorly and posteriorly.⁸ Two ligaments attach to the ovary: the ovarian ligament and the suspensory ligament.⁸ Four ligaments attach to the uterus which includes the round ligament, cardinal ligament, pubocervical ligament, and uterosacral ligament.⁸

The pelvic floor muscles are divided into three layers and are illustrated with a lateral view in Figure 4 of Appendix A. The first layer is considered the superficial layer which includes the ischiocavernosus, bulbocavernosus, superficial transverse perineal muscles, and external anal sphincter muscle.^{6,7} The second layer is deep to the superficial layer and contains a thick, fibrous sheet of dense fascia called the perineal membrane.⁷ The second layer is often referred to as the urogenital diaphragm and includes the deep transverse perineal, sphincter urethrovaginalis, compressor urethra, and external urethral sphincter muscles.^{6,7} The third layer is considered to be the pelvic diaphragm and includes the levator ani (pubococcygeus, puborectalis, iliococcygeus) and coccygeus muscles.^{6,7} The levator ani is innervated by the anterior ramus of S4 and branches of the pudendal nerve (S2 – S4).⁷ The coccygeus is innervated by the anterior rami of S4 and S5.⁷ The pubococcygeus acts to support the pelvic viscera and pulls the coccyx towards the pubic

bone.⁷ The puborectalis acts to elevate and constrict the anal canal.⁷ The iliococcygeus supports the viscera and pulls the rectum and vagina forward. The coccygeus flexes the coccyx, supports the viscera, and stabilizes the sacroiliac joint.⁷ The pelvic wall, or the lateral borders of the pelvic musculature, consists of the piriformis and obturator internus muscles.⁷

Lumbopelvic pain can occur as a result of a primary dysfunction of the pelvic floor muscles or abdominal muscles, ligaments, tendons, nerves, or as a functional adaptation to other disorders within the pelvis or spine.⁶ Any of the previously discussed anatomical structures can influence the severity and intensity of lumbopelvic pain during pregnancy. For example, pain within the pelvic floor muscles can refer to the pelvis, back, abdomen, bladder, buttocks, and distal leg.⁶ Various skeletal pathologies can also contribute to lumbopelvic pain such as sacroiliac dysfunction; symphysis pubis inflammation or injury; and coccyx injury or malposition.⁶ Muscular etiologies contributing to lumbopelvic pain include levator ani and piriformis syndromes. Muscular injury can be a result of trauma, repetitive use, or underuse. Pain in this region can also develop secondary to other pain syndromes such as irritable bowel syndrome, pudendal nerve neuropathy, and painful bladder syndrome.⁶

Etiology and Risk Factors:

Unfortunately, pregnancy-related lumbopelvic pain has a poorly understood etiology.⁵ Many hypothesize that there are hormonal, mechanical, traumatic, degenerative, and metabolic factors that contribute to this condition.⁵ In pregnant females, hormonal changes often accompany an increase in body mass. During pregnancy the hormones relaxin, progesterone, and estrogen all increase. Relaxin is a hormone produced by the placenta that increases in early pregnancy, peaks at the end of the first trimester, but remains high until late pregnancy.⁹ Estrogen enhances relaxin receptor sensitivity, thus heightening its influence on joint laxity. Joint

laxity is considered one of the etiologies influencing low back pain and pelvic pain in pregnant females. For example, pregnant females with moderate to severe posterior pelvic pain often exhibit asymmetric sacroiliac joint laxity.⁹ Additionally, individuals with pregnancy-related low back pain tend to have greater pubic symphysis mobility compared to asymptomatic pregnant females.⁹

It is recommended that females gain between 25 to 35 pounds during pregnancy, with over half of this weight gain occurring in the abdomen.⁹ This abdominal growth causes an anterior shift in the center of gravity, which exerts additional static and dynamic loads on the axial skeleton.⁹ This also causes postural compensations to occur which can influence the development of pregnancy-related lumbopelvic pain as depicted in Figure 1 of Appendix B. With a growing abdomen, the abdominal muscles are stretched and become weak which increases the strain placed on the lumbar muscles.⁹ The pelvis during pregnancy rotates within the sagittal plane which causes compensatory hyperlordosis since the center of gravity has shifted anteriorly as seen in Figure 2 of Appendix B. This anterior shift in the center of gravity causes a flexion moment of the lumbar spine with further increases the load experienced by the lumbar musculature.⁹ Additionally, this anterior shift in the center of gravity causes a greater anterior pelvic tilt, increasing the load through the sacroiliac ligaments attempting to resist this rotation.⁹ With hormones increasing the laxity of these ligaments combined with exaggerated compensatory postures, axial loading of the spine will significantly increase. A study found that spinal compression from physical activity is higher and post-activity recovery takes longer to occur in pregnant females with low back pain compared to asymptomatic pregnant or non-pregnant females.⁹

Some researchers propose that peripheral and central neuropathic mechanisms influence central sensitization in females before, during, and after pregnancy thus heightening their pain experience.⁵ Others believe that vascular changes contribute to pregnancy-related lumbopelvic pain.⁹ The growing uterus can put compression on the aorta and vena cava when the pregnant female is in a supine position. This compression can increase the risk for thromboembolism and subsequent stasis with decreased oxygen saturation.⁹ If either were to occur, hypoxemia could compromise the metabolic activity of the surrounding neural structures.⁹

The risk factors associated with pregnancy-related lumbopelvic pain are multifactorial. The previously discussed pregnancy-related structural changes such as increased joint laxity, anterior displacement of the center of gravity, increased axial loading, and vascular changes all increase one's risk for developing pain.⁴ Research suggests, however, that physical activity may lessen the degree of biomechanical change that occurs as pregnancy advances by decreasing the axial load on the spine, increasing joint stabilization through surrounding musculature, and enhancing spinal alignment and segmental motion.⁴

Once pregnancy-related lumbopelvic pain has been experienced, there is an 85% greater likelihood of developing recurrent pain.⁴ Risk factors can be categorized based on when they are experienced during pregnancy but it should be noted that some risk factors occur in multiple categories. Risk factors for pregnancy-related lumbopelvic pain during pregnancy include back pain before pregnancy that required intervention; abdominal pain before pregnancy; and history of pregnancy-related lumbopelvic pain in previous pregnancies.⁵ Risk factors during postpartum include a history of back pain pre-pregnancy; pain during pregnancy; increased pain intensity during pregnancy; increased pain intensity during delivery; and history of pregnancy-related lumbopelvic pain in previous pregnancies. Risk factors for chronic or persistent pregnancy-

related lumbopelvic pain include a body mass index ≥ 25 ; a younger age; and hypermobility, but their influence is still debated in the literature.⁵

Patient Presentation:

Due to the unknown etiology of pregnancy-related lumbopelvic pain and the various structures that can impact pain experienced in this population, the patient presentation will vary. Typically, patients with pregnancy-related lumbopelvic pain will have a difficult time localizing and describing their pain.^{5,6} Pain could be localized to the pubis symphysis, posterior pelvis at the sacroiliac joint, low back, gluteal region, groin, radiate down the distal leg or be a combination of any of the aforementioned areas.^{5,6} The intensity and frequency of pain will also vary.⁵ In some cases pain is constant whereas for others it is intermittent.⁵ Given the previously discussed influence of hormones on joint laxity, many patients will report variations of pain related to the timing of their menstrual cycle.⁶ The pain may be described by the patient as aching, cutting, dull, or stabbing.⁵ However, pain is more often unilateral and patients commonly describe “heaviness” or “pelvic pressure” when discussing their pain experience.⁶ Additionally, pain in the low back that radiates to the levator ani insertion is common.⁶ Pain cycle and aggravators may help a therapist determine what structures are contributing most significantly to the patient’s pain experience. For instance, pain that radiates to the hip and down the back of the thigh is characteristic of neuropathy or piriformis muscle irritation.⁶ Pain in the afternoon that worsens throughout the day is common in individuals with levator ani syndrome.⁶ Other musculoskeletal signs include worsened pain with prolonged sitting or standing, anxiety, bowel movements, physical activity, or during sexual intercourse.⁶ Other commonly reported activities that may evoke pain in this patient population include lying, parting or lifting legs, turning in

bed, getting up from a chair or bed, walking, climbing stairs, lifting light loads, housework, childcare, and shopping.⁵

If pain is experienced only in the low back, patients will often report the first experience of pain before pregnancy.⁹ Additionally, they will present with decreased lumbar range of motion and may experience tenderness to palpation of the lumbar paraspinals.⁹ Their pain may also be exaggerated with prolonged postures of over 30 minutes, and forward spinal flexion.⁹

Contrastingly, if a patient reports pain only in the pelvic region, then their pain typically is not experienced until their first pregnancy.⁹ Their lumbar range of motion will appear relatively normal but they may experience tenderness to palpation of the sacroiliac joint and gluteal musculature.⁹ These patients will also likely experience pain with walking and standing.⁹ It is not uncommon for patients with pregnancy-related lumbopelvic pain to also report symptoms like dyspareunia, voiding dysfunction, and constipation.⁶ Depending on your setting, patients may not be forthright with symptoms related to bowel, bladder, and sexual dysfunction so additional questioning may be required during the examination. It is also important to ask about the history of trauma to the pelvis from falls, automobile accidents, sports, exercise, or childbirth instrumentation.⁶ Additionally, it is not uncommon for patients with pregnancy-related lumbopelvic pain to have a history of physical or psychological abuse.⁶ History of trauma is often difficult to determine or detect but signs or reported symptoms may include difficulties with focusing and memory; difficulty sleeping and relaxing; fear and anxiety around taking risks; self-doubt and perfectionism; chronic fatigue and exhaustion; difficulty maintaining motivation and a sense of purpose; chronic pain; digestive problems; and muscle tension during physical contact.¹⁰

Suggested Examination:

A thorough history should be taken at the start of an examination with consideration made to the typical patient presentation previously discussed. This should be performed through active listening of the patient's pain story regarding the site of pain, activity limitations, history of pain before current pregnancy or in previous pregnancies.⁵ The therapist should also explore the patient's concerns regarding the nature of the pain and assure the health and wellbeing of the unborn child, as this is a common concern expressed by pregnant females experiencing pain mid-pregnancy.⁵

Following a thorough patient history, the following items should be assessed: gait and seated posture; integrity of the lumbar spine and pelvic joints; skin integrity; muscle strength, sensation, and reflex testing; and pelvic provocation testing.^{6,9} A pelvic floor therapist should also perform an internal pelvic and rectal examination.⁶ If an individual is not a pelvic floor physical therapist, this should be a referral when pregnancy-related lumbopelvic pain is suspected since there is an association between lumbopelvic pain and bowel, bladder, and sexual function. If pregnancy-related lumbopelvic pain is suspected, therapists may observe a slowed gait with a limp and frequent position changes when the patient is seated due to discomfort.⁶ Therapists during the lumbar spine and pelvic joint assessment are looking at the curvature, symmetry, and tone of the paraspinals and surrounding musculature.⁶ In patients with pregnancy-related lumbopelvic pain, therapists may observe limitations in the range of motion of the hip or lumbar spine and may find that the sacroiliac joint and pubic symphysis are tender to palpation.⁶ During the skin assessment, therapists are looking for scarring, lesions, skin changes, atrophic or dermatologic changes.⁶ During an internal pelvic and rectal exam, therapists are visualizing and palpating for perineal lift during a pelvic floor muscle contraction followed by full relaxation to assess tone, voluntary muscle control, and rule out pelvic organ prolapse.⁶ If the pelvic floor

musculature is healthy, neither contraction nor relaxation should be painful.⁶ A therapist, however, may find trigger points in the pubococcygeus, iliococcygeus, obturator internus, and coccygeus during internal palpation which indicates increased tone.⁶ Lastly, a therapist can perform pelvic provocation tests, outlined in Table 2 of Appendix C, to determine if pelvic girdle pain is present.⁹ Given the multifactorial etiology and heterogeneous patient presentation, therapists should also keep in mind other musculoskeletal, neurologic, and systemic diagnoses. An extensive but not comprehensive list of differential diagnoses for pregnancy-related low back and pelvic girdle pain can be found in Table 1 of Appendix C. If symptoms are severe enough or believed to be associated with neurologic compromise, then therapists should consider referring for imaging. MRI is the preferred imaging for females during pregnancy since it is safe for the mother and child.⁹ However, the timing of the MRI may influence its appropriateness. For instance, the International Commission on Non-Ionizing Radiation Protection recommends delaying elective MRI imaging until after the first trimester of pregnancy.⁹ The American Congress of Obstetricians and Gynecologists state that during pregnancy, imaging procedures with non-ionizing radiation should be considered first over ionizing- radiography when appropriate.⁹

Treatment Options:

Overall, there are mixed findings and limited evidence-based treatment approaches for pregnancy-related lumbopelvic pain. A systematic review found moderate evidence for the use of exercise therapy to reduce pain intensity, disability, and sick leave for patients with pregnancy-related lumbopelvic pain.³ All studies reviewed included extensive education that discussed anatomy, pathology, changes during pregnancy, posture, self-management, activity modifications, activities of daily living, and relaxation.³ Reviewers concluded that extensive

education has a positive effect on pain, disability, and sick leave.³ For example, the therapist may make postural and activity modification recommendations to decrease the impact of lumbopelvic pain during pregnancy. It is suggested that to reduce pressure on visceral structures, females should either position themselves on all fours and alternate between spinal flexion and extension or bend forward in a chair and practice breathing control.⁵ To reduce hyperlordosis, females should use a well-supported chair that keeps their low back in a neutral position. It is also encouraged for females to alter their position often, in seated or standing.⁵ When standing up from a chair, females can place their feet further apart than normal and lean forward with their shoulders over their thighs before pushing into standing.⁵ Lastly, when lying, it is recommended that females lay on their side with their hips and knees flexed, with a pillow between their knees.⁵ Therapists can also make recommendations for the use of external supports. A systematic review found strong evidence for the use of pelvic belts in treating lumbopelvic pain during pregnancy.¹¹ Different types of pelvic belts reduced pain intensity, but a rigid belt was found to be most effective for those with symphyseal pain.¹¹ For females with pelvic girdle pain only, a non-rigid belt was most effective and authors concluded that pelvic belts should be the first choice to stabilize the pelvis before exercise.¹¹ Additionally, therapists may recommend wearing supportive shoes and sleeping on a firm mattress during pregnancy since these are general guidelines supported by the American College of Obstetricians and Gynecologists.¹²

In terms of exercise prescription, a meta-analysis found that exercise during pregnancy prevented new episodes of sick leave by over 20%.¹ Unfortunately, the authors also found exercise to have no statistically significant protective effect on the development of lumbopelvic pain during pregnancy.¹ Authors did note, however, that exercises that improve muscle strength and endurance are more effective in the prevention of new episodes of pain when they are

habitual.¹ A Cochrane Review found that when exercise interventions were compared to usual prenatal care, females experienced significant improvements in back pain and levels of disability.¹³ Reviewers found moderate-quality evidence that eight to twelve-week exercise programs can reduce the number of females who report low back and pelvic pain during pregnancy.¹³ Reviewers also found moderate-quality evidence that manual therapy significantly reduced low back pain, pelvic pain, and functional disability more so than standard prenatal care.¹³ Manual therapy included stretching, gentle pressure, resistance, acupuncture, and craniosacral therapy. Another systematic review found evidence that pelvic floor muscle training was an effective treatment for pregnancy-related lumbopelvic pain since it significantly reduced pain and disability short-term.¹⁴ However, pelvic floor muscle training was not found to be superior to the usual physical therapy care of electrical stimulation, manual therapy, ultrasound, and back strengthening exercises.¹⁴ There is also promising evidence that yoga-based interventions are helpful for pain reduction and prevention of pregnancy-related lumbopelvic pain.¹² Unfortunately, it is near impossible to recommend a particular type of exercise for this diagnosis because no reviews have conclusively shared a recommendation for the type of exercise to use. Although there are no recommended exercises to use, there are guidelines for exercises to avoid during pregnancy.

To ensure safety with exercise prescription in pregnant patients, the American College of Obstetricians and Gynecologists committee created a guideline for safe-exercise during pregnancy.¹⁵ They stated that physical activity during pregnancy is associated with minimal risks, however, given the normal anatomic, physiological changes, and fetal requirements, females may need to modify their exercise routines.¹⁵ Additionally, a thorough evaluation is required before starting exercise during pregnancy. Females with uncomplicated pregnancies are

encouraged to participate in aerobic and strength conditioning before, during, and after pregnancy as it promotes physical fitness, prevents comorbidities, manages weight, and improves psychological well-being.¹⁵ There are, however, absolute and relative contraindications to exercise during pregnancy. Additionally, there are warning signs providers should recognize to stop exercise as well as safe and unsafe activities. These contraindications, warning signs, and safe activities are listed in Tables 1 – 3 in Appendix D.

In terms of treatment options outside of the scope of physical therapy, pharmacologic management, acupuncture, massage, behavioral therapy, and relaxation may be helpful in this patient population.^{9,12} Oral acetaminophen is the first choice analgesic for back pain during pregnancy due to its low levels of teratogenic properties.⁹ FDA classifies this drug as level B meaning there is currently no evidence that use during pregnancy causes harm to the fetus according to animal studies.⁹ If NSAIDs are used, they should only be used on a short-term basis and restricted to the first and second trimester because it can prematurely close the ductus arteriosus which is essential for fetal circulation.⁹ Full dose aspirin, methocarbamol, and opioids should be avoided as they have been found to cause birth defects.⁹

Surgical intervention is not often recommended in this patient population. It is also important to note that pain should never be the sole indication for surgery in pregnant patients.⁹ If pain is unbearable and unresponsive to conservative measures, or if neurological compromise is suspected, surgery may be used sparingly in this patient population.⁹ If surgery is required, then careful consideration is made to the patient's position during surgery depending on the timeline of their pregnancy. For instance, if surgery occurs in the first trimester the patient is positioned in prone.⁹ If surgery occurs in the second trimester, then the patient is positioned in side-lying.⁹ If surgery occurs in the third trimester, then the patient is placed in left side-lying

because right side-lying increases the risk for compression of the vena cava.⁹ Additionally, if surgery is scheduled to occur after 34 weeks' gestation, then surgeons determine if delivery needs to occur before surgery for the overall safety of the mother and child.⁹

Conclusion:

Overall, pregnancy-related lumbopelvic pain can significantly impact the quality of life, psychological well-being, and function of females well-beyond their delivery date. Despite estimates of high prevalence rates, many females continue to report inadequate care related to lumbopelvic pain during pregnancy. Health care providers, especially physical therapists, have a unique opportunity and responsibility to provide informed and empathetic care to these patients. Physical therapists can better serve this patient population if they have a deep understanding of anatomical and biomechanical changes that occur during pregnancy and their influence on lumbopelvic pain. The information outlined in this paper is intended to enhance the physical therapist's knowledge regarding the recognition and management of pregnancy-related lumbopelvic pain. Topics addressed within this paper will allow physical therapists to strengthen their subjective and objective examination procedures, improve their patient education, and refine their plan of care to incorporate evidence-supported interventions.

Appendix A – Relevant Anatomy

Fig. 1. Depicted below is an illustration of the bony pelvis and relevant anterior ligaments. Image reprinted from learnmuscles.com¹⁶.

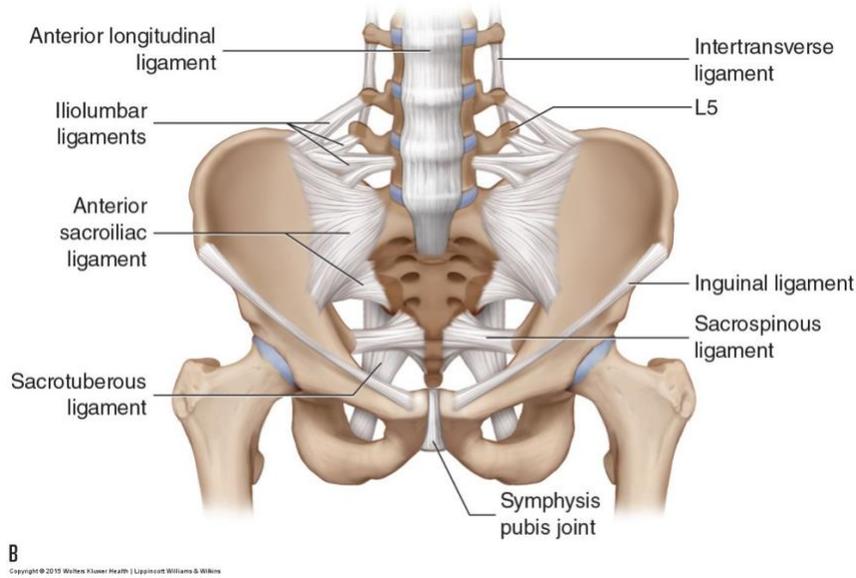


Fig. 2. Depicted below is an illustration of the bony pelvis and relevant posterior ligaments. Image reprinted from learnmuscles.com¹⁶.

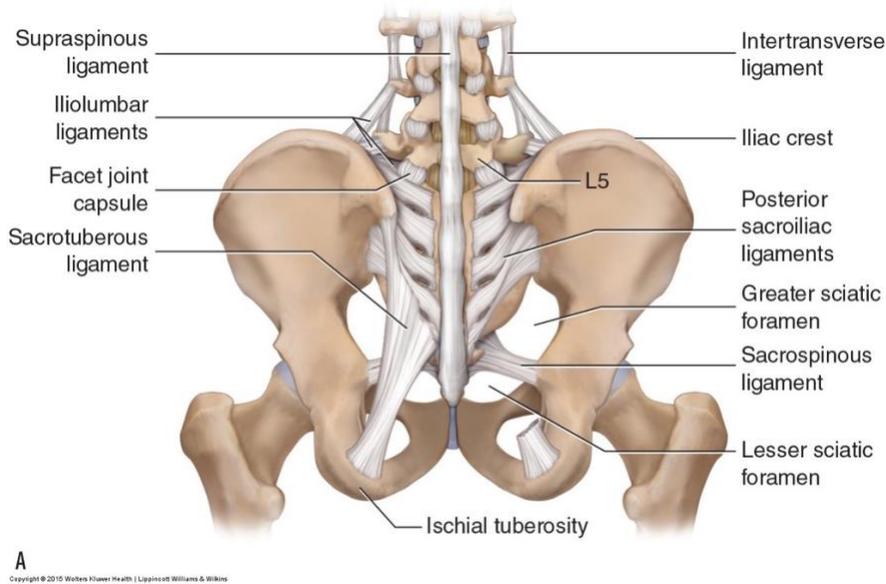
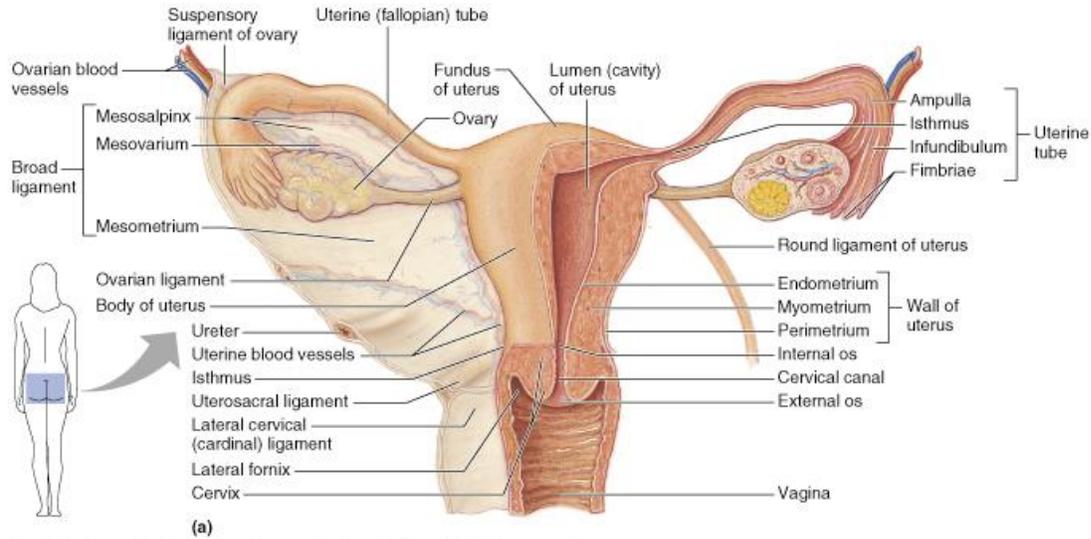
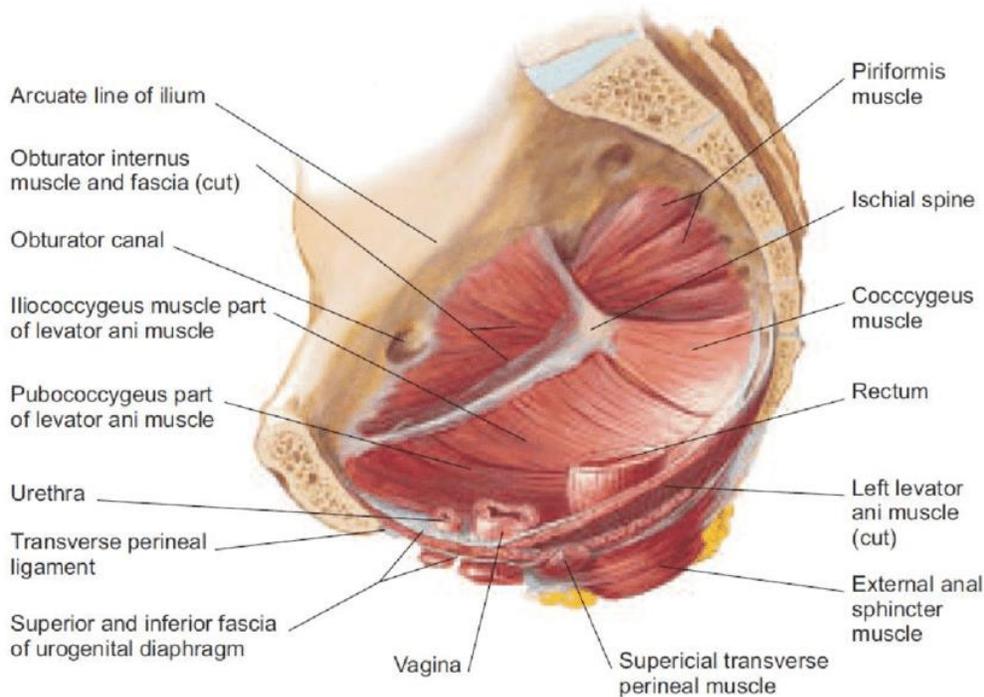


Fig. 3. Depicted below is an illustration of the female reproductive system and relevant female-specific ligaments. Image reprinted from ovarian anatomy.¹⁷



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Fig. 4. Depicted below is an illustration of the pelvic floor and wall muscles of the female pelvis. Image reprinted from Netter, 2002.¹⁸



Appendix B – Biomechanical Changes During Pregnancy

Fig. 1. Depicted below is an illustration demonstrating and describing the musculoskeletal compensations seen during pregnancy. Image reprinted from Casagrande et al., 2015.⁹

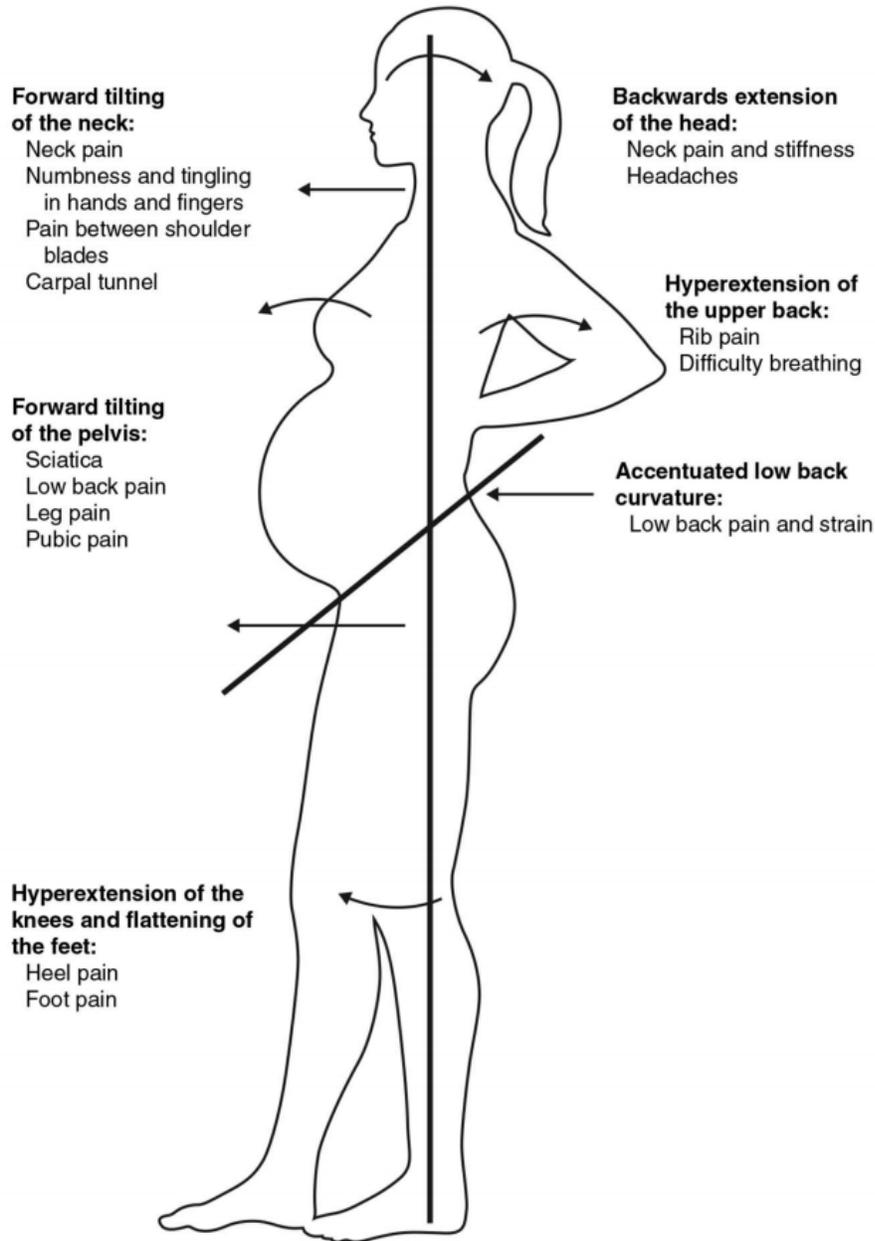
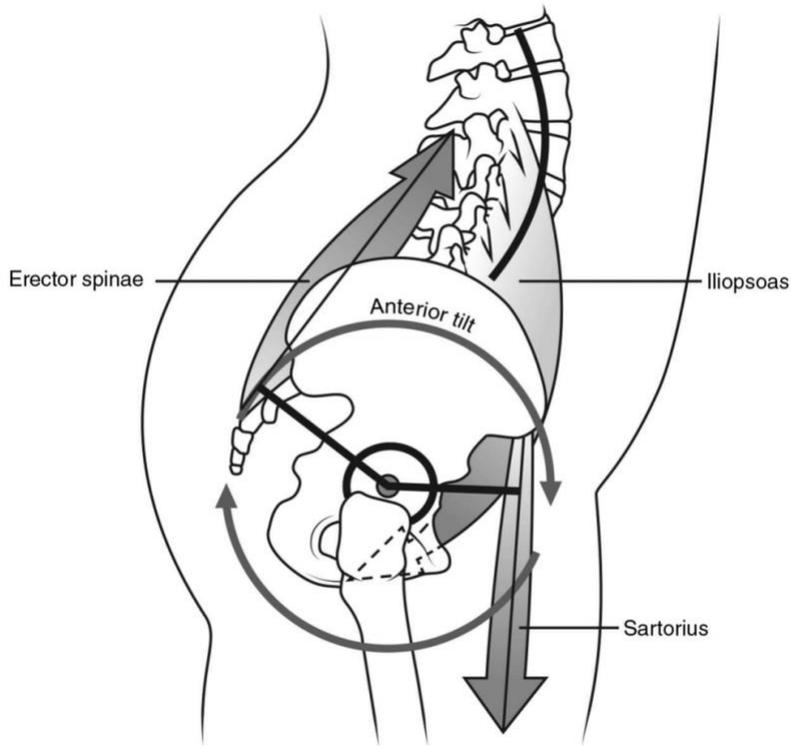


Fig. 2. Depicted below is an illustration demonstrating anterior pelvic tilt and compensatory hyperlordosis experienced during pregnancy. Image reprinted from Casagrande et al., 2015.⁹



Appendix C – Physical Therapy Examination

Table 1: Differential Diagnosis for Pregnancy-Related Lumbopelvic Pain. Table adapted from Casagrande et al., 2015.⁹

Differential Diagnosis for Low Back Pain (LBP) and Pelvic Girdle Pain (PGP) in pregnancy	
LBP	PGP
Osteoarthritis – lumbar spine, SI joint, hip	Painful visceral pathologies of the pelvis – urogenital or Gastrointestinal
Stress fracture – sacrum, ilium, femur	Syphilitic lesion of pubis
Lumbar disk herniation	Lumbar disk herniation
Lumbar radiculopathy	Lumbar radiculopathy
Spondylolisthesis/spondylolysis	Rheumatism
Rheumatism	Sciatica
Sciatica	Spinal stenosis
Spinal stenosis	Lumbar spine arthritis
Lumbar spine arthritis	Tuberculosis
Tuberculosis	Urinary Tract Infection
Urinary Tract Infection	Rupture of symphysis pubis
Rupture of symphysis pubis	Sacroiliac Joint sprain
Sacroiliac Joint sprain	Osteitis pubis
Osteitis pubis	Chorioamnionitis
Chorioamnionitis	Femoral vein thrombosis
Femoral vein thrombosis	Preterm labor
Preterm labor	Placental abruption
Placental abruption	Round ligament pain
Round ligament pain	Bone or soft tissue tumor
Bone or soft tissue tumor	
Ankylosing spondylitis	
fibromyalgia	
Red degeneration of leiomyoma	
Pregnancy-related osteoporosis	
Cauda equina	
Osteomyelitis	

Lumbar facet arthropathy	
Osteonecrosis of hip	
Appendicitis	
Pyelonephritis	
Hydronephrosis	
Renal Calculi	
Aortic aneurysm	

Table 2. Descriptions of Provocation Test for Pelvic-Girdle Pain (PGP). Table adapted from Casagrande et al., 2015.⁹

Provocation Tests for PGP		
Test	Maneuver	Indication of Positive Test
Posterior Pelvic Pain Provocation Test	Patient lies supine with hip flexed to 90 degrees. Pressure is applied to the flexed knee along the femoral longitudinal axis while the pelvis is stabilized with a hand placed on the opposite anterior superior iliac spine.	Deep pain in gluteal region
FABER – Flexion, Abduction, External Rotation	Patient lies supine with the hip flexed, abducted, and externally rotated so that the heel comes to rest on the opposite knee. With the patient relaxed, the weight of the leg causes the knee to drop toward the floor	Pain in ipsilateral sacroiliac joint or pubic symphysis
Long dorsal Sacroiliac Ligament Test	Patient lies on side, with both the hip and knee in slight flexion. Directly under the caudal part of the posterior superior iliac spine, the long dorsal sacroiliac ligaments, bilaterally, are palpated	Intensity of tenderness is related to severity of condition
Active Straight Leg Raise	Patient lies supine with the legs straight and the feet 20 cm apart. The patient raises one leg at a time, 20 cm above the examination table, while maintaining a straight knee	Degree of difficulty in performing this test is an indicator of the severity of the condition
Pain Provocation of Pubic Symphysis During the Modified Trendelenburg Test	Patient stands on one leg with the hip and knee of the contralateral leg flexed to 90 degrees.	Symphyseal pain is experienced during this maneuver

Appendix D – Recommended Guidelines for Exercise During Pregnancy

Table 1. Absolute and Relative Contraindications to Aerobic Exercise in Pregnancy. Table adapted from Artal, 2016.¹⁵

Absolute Contraindications	Relative Contraindications
Hemodynamically significant heart disease	Anemia
Restrictive lung disease	Unevaluated maternal cardiac arrhythmia
Incompetent cervix	Chronic Bronchitis
Multiple gestations at risk of premature labor	Poorly controlled Type 1 Diabetes
Persistent second-trimester or third-trimester bleeding	Extreme morbid obesity
Placenta previa after 26 weeks of gestation	Extreme underweight (body mass index <12)
Ruptured chorioamniotic membranes	History of extremely sedentary lifestyle
Premature labor during current pregnancy	Intrauterine growth restriction during pregnancy
Preeclampsia or pregnancy-induced hypertension	Poorly controlled hypertension
Severe anemia	Orthopedic limitations
	Poorly controlled seizure disorder
	Poorly controlled hyperthyroidism
	Heavy smoker

Table 2. Warning Signs to Discontinue Exercise in Pregnancy. Table adapted from Artal, 2016.¹⁵

Warning Signs
Vaginal bleeding
Regular and painful uterine contractions
Amniotic fluid leakage
Dyspnea before exercise
Dizziness
Headache
Chest pain
Muscle weakness affecting balance
Calf pain or swelling

Table 3. Safe and Unsafe Physical Activities During Pregnancy. Table adapted from Artal, 2016.¹⁵

Safe Physical Activities	Unsafe Physical Activities
Walking	Contact sports: <ul style="list-style-type: none"> - Boxing - Ice hockey - Soccer - Basketball
Swimming	Activities with a high risk of falling: <ul style="list-style-type: none"> - Downhill snow skiing

	<ul style="list-style-type: none"> - Water skiing - Off-road cycling - Gymnastics - Horseback riding
Stationary Cycling	Scuba Diving
Low-impact aerobics	Sky Diving
Certain types of yoga and modified Pilates	
For previously active females: <ul style="list-style-type: none"> - Running or jogging - Racquet sports - Strength training 	

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