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Physical Therapy Management Of Low Back Pain In A Young Female With Ankylosing Spondylitis Associated With HLA-B27 Antigen: A Case Report

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1 **Physical Therapy Management of Low Back Pain in a Young Female with**
2 **Ankylosing Spondylitis Associated with HLA-B27 Antigen: A Case Report**

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9
10 The patient signed a consent form allowing her medical history, any photograph or video
11 footage, and her name to be used for this case report. She received information regarding the
12 University's Health Insurance Portability and Accountability Act (HIPAA) policies.

13
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19
20 Key words: ankylosing spondylitis, axial spondyloarthritis, HLA-B27, low back pain, physical
21 therapy

25 **Abstract**

26 Background and Purpose: Ankylosing spondylitis (AS) is a form of arthritis characterized by
27 chronic inflammation of the axial skeletal system that causes back pain and loss of mobility with
28 strong potential for slow, eventual spinal fusion. The condition affects 0.2-0.5% of the United
29 States population. There is no known cure for AS and the cause is unknown. The purpose of this
30 case report is to describe a comprehensive approach for physical therapy (PT) management of
31 AS in order to assist clinical reasoning and clinical decision-making and enhance care
32 management in this patient population.

33 Case description: A 27-year old female referred to PT for low back pain after diagnosis of AS.
34 Patient presented with range of motion, strength, and balance deficits along with neurological
35 signs and symptoms. Key interventions during episode of care involved targeted therapeutic
36 exercise, soft tissue mobilization, modality use, and pharmacological management.

37 Outcomes: After 13 weeks of PT, significant changes included Oswestry Disability Index (32-
38 50/100), Numeric Pain Rating Scale (1-10/10 – 0-6/10), straight leg raise (left: 35°-60°, right
39 36°-72°), and improvements in lower extremity strength and lumbar range of motion,
40 particularly lateral flexion (left: 14 cm, painful – 14 cm, right: 7 cm, painful – 14 cm). Patient
41 reported the initiation of pharmaceutical therapy provided greatest degree of relief. Soft tissue
42 mobilization combined with modalities during PT provided consistent but short-term relief.

43 Discussion: A multi-modal approach of pharmaceutical intervention combined with targeted,
44 symptom-specific PT intervention appeared to be beneficial for this patient. Future research and
45 development of a clinical practice guideline could assist clinical decision-making and improve
46 consistency of care for this population.

47
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49

50 **Introduction, Background, and Purpose**

51 Ankylosing spondylitis (AS) is a form of arthritis characterized by chronic inflammation
52 of the axial skeletal system that causes back pain and loss of mobility with strong potential for
53 slow, eventual spinal fusion. The condition affects 0.2-0.5% of the United States population and
54 is more frequent in men than women (2:1) with age of onset most commonly between 20-40
55 years of age.¹ There is no known cure for AS and the cause is unknown, yet greater than 60
56 heritable genetic components have been found to be associated with its diagnosis.² The human
57 leukocyte antigen (HLA) group is responsible for distinguishing healthy proteins from proteins
58 made by foreign invaders in the immune system.³ The presence of a particular antigen, HLA-
59 B27, is highly correlated with diagnosis of AS with up to 90% of ethnic patients and
60 approximately 20% of all cases testing positive for this antigen.³ Its presence produces an
61 accumulation of misfolded proteins that leads to an influx of various cytokines, ultimately
62 creating an inflammatory response at the bony attachment sites of tendons, ligaments, and joint
63 capsules.³

64 Patient presentation of AS can vary widely. Some may experience intermittent back pain
65 whereas others may experience significant and chronic pain and stiffness across multiple body
66 segments. Peripheral joints may be involved, but the hallmark feature is involvement of the
67 sacroiliac (SI) joints.^{2,4} Chronic inflammatory-related comorbidities associated with AS include
68 osteoporosis, hypertension, cardiovascular disease, uveitis, psoriasis, and inflammatory bowel
69 disease.⁴ Diagnosis is made using the 1984 Modified New York classification criteria for AS.¹

70 The 2015 recommendations by the American College of Rheumatology, Spondylitis
71 Association of America, and Spondyloarthritis Research and Treatment Network for medical
72 management of AS includes strong recommendations for pharmacological intervention,
73 including non-steroidal anti-inflammatory drugs and tumor necrosis factor inhibitors (TNFi), and

74 physical therapy (PT).⁵ Moderate-quality evidence supports land-based PT over aquatic-based
75 PT and very low quality evidence supports active interventions (exercise) over passive
76 interventions (massage, ultrasound, heat).⁵ Due to the progressive nature of AS, primary goals of
77 management include relieving symptoms, preserving physical function, and sustaining quality of
78 life.¹

79 This case report was chosen because limited evidence of PT management in patients with
80 AS was available to guide clinical decision-making and determine effective therapeutic
81 interventions. Interventions and techniques were selected using the Clinical Practice Guideline
82 (CPG) for spinal stenosis, referenced as a comparative patient population, as well as case reports
83 and current research available regarding AS. The purpose of this case report is to describe a
84 comprehensive approach for PT management of AS in order to assist clinical reasoning and
85 clinical decision-making and enhance care management in this patient population.

86 **Patient History and Systems Review**

87 The patient signed a consent form allowing her medical history and any photograph or
88 video footage to be used for this case report. She received information regarding the University's
89 Health Insurance Portability and Accountability Act (HIPAA) policies.

90 The patient was a 27-year old female patient services representative who presented to
91 outpatient PT with a referral from her rheumatologist for conservative management of low back
92 pain (LBP) with radicular symptoms. Magnetic resonance imaging of the lumbar spine
93 confirmed a medical diagnosis of AS. Past medical history of the prior year included: transient
94 ischemic attack, multiple seizures, rapid onset shortness of breath, insomnia, adrenal
95 insufficiency, and recent onset auto-immune inflammatory disorder that was in the initial stages
96 of diagnosis and medical management. Her brother, mother, aunt, and uncle also tested positive
97 for the HLA-B27 antigen which led to her request for lab testing, and ultimately, her diagnosis.

98 The patient reported LBP began with insidious onset approximately three years prior with
99 symptoms worsening over the past year. Pain presented bilaterally in the low back and hips, and
100 right knee. Parasthesia commonly occurred down her left leg to the foot and occasionally down
101 her right leg to the knee. The patient denied bowel and bladder issues and saddle anesthesia. She
102 reported independence with all activities of daily living (ADLs) but occasionally limited or
103 modified activity when pain increased significantly. Her low back pain was rated 1/10 at its best
104 and 10/10 at its worst using the Numeric Pain Rating Scale (NPRS). Pain was relieved minimally
105 with constant position shifting and prescribed medication and previous PT and chiropractic care
106 provided minimal relief for short periods of time. The results of the systems review is provided
107 in Table 1 and the patient's medication list is provided in Appendix 1.

108 The patient lived at home with her husband, who was active military, her two dogs, and
109 cat. She enjoyed hiking, Pilates, and walking with her dogs. She also attended a local gym 3-4
110 days per week for aerobic exercise and light resistance training with her personal trainer who
111 followed PT recommendations. These activities became less enjoyable and she ultimately ceased
112 some of these activities due to significance of pain and difficulty to perform. The patient
113 expressed understanding of the progressive nature of her condition. Despite feeling overwhelmed
114 at times, she was motivated to maintain a healthy lifestyle and participate fully in any care that
115 would help her maintain or improve independence and mobility. She stated her main goals of
116 therapy to be reduced pain, decreased need for pain medication, return to active lifestyle, and
117 limit progression of her condition. These goals were appropriate for her diagnosis and were
118 utilized to determine her plan of care and to monitor progress made during this episode of care.

119 **Clinical Impression**

120 Due to the patient's medical diagnosis confirmed with imaging, a differential diagnosis
121 was not planned. Objective measures were used to measure mobility, determine directional

122 preference, and obtain baseline data to determine the plan of care (POC) and progression of
123 symptoms over the course of treatment. Tests and measures used included: range of motion
124 (ROM), manual muscle testing (MMT), neural assessment, dermatomal sensation, reflex
125 integrity, balance, lumbar soft tissue and joint mobility, and sacroiliac (SI) soft tissue and joint
126 mobility. As the patient presented, the CPG set forth by the Academy of Orthopaedic Physical
127 Therapy for Low Back Pain⁶ with special emphasis on lumbar stenosis in addition to published
128 research of patients with similar presentation was used as a reference for navigating patient
129 evaluation and management.

130 The patient was an excellent candidate for a case report due to the rarity of her condition,
131 medical comorbidities, and multiple system involvement that created a high-complexity case.
132 With the lack of evidence currently published to support this population, this case report can be
133 used to help guide future PT practice for similar patients.

134 **Examination – Tests and Measures**

135 At initial examination, the patient completed the Oswestry Disability Index (ODI), a self-
136 reported questionnaire that assesses low back symptom severity and its impact on a variety of
137 basic daily activities such as personal care, walking, standing, sleeping, sex, social life, and
138 travel with a greater score indicating a greater level of disability.⁷ At the time of this case report,
139 limited evidence had been published on its use, validation, and reliability for AS. The ODI was
140 chosen for its focus on impact of pain on function, ease of administration, and good construct
141 validity, reliability, and responsiveness for LBP⁸ and SI joint pain⁹ and is recommended based on
142 strong evidence for patients with lumbar stenosis.⁶ The minimally clinically important difference
143 (MCID) is a 10-point change and should be considered when assessing change over time.⁸ The
144 patient's ODI score of 32% fell between the 21-40% range that indicated a moderate level of
145 disability.¹⁰

146 Active range of motion (AROM) of thoraco-lumbar spinal flexion and extension, and
147 lumbar lateral flexion and rotation was assessed according to the techniques determined by
148 Norkin and White and the patient fell below age-related normal motion for flexion, extension,
149 and lateral flexion bilaterally, right greater than left¹¹ with increased pain in all planes of
150 movement in addition to a positive Gower's sign. Manual muscle testing (MMT)¹² was assessed
151 in accordance with myotomes due to the patient's neurologic presentation. Trunk MMT was
152 deferred due to significant pain during all planes of active lumbar movement. Lower extremity
153 (LE) MMT demonstrated decreased hip strength with pain and pronounced weakness in the
154 plantarflexors.

155 Neural assessment and segmental joint mobility assessment as described by Delitto et al.⁶
156 indicated decreased neural mobility with positive findings bilaterally during straight leg raise
157 (SLR) and slump test. Lumbar vertebral hypomobility with reproduction of pain indicated
158 decreased nerve mobility and nerve root impingement.⁶ A positive lumbar distraction test and
159 neurological symptoms indicated the patient could benefit from further treatment using this
160 technique for the purposes of symptom management.¹³ Further neural assessment included
161 sensory testing, balance screen, and deep tendon reflex testing as described by O'Sullivan.¹⁴
162 Upon testing, the patient demonstrated altered reflexes, impaired lower extremity sensation, and
163 required multiple trials to demonstrate average single leg balance which indicated an elevated
164 risk for future falls.¹⁴

165 Passive hip rotation and muscle length special tests were assessed according to Norkin
166 and White.¹¹ Hip ROM was within normal limits (WNL)¹¹ with noted pain in the low back at end
167 ranges of flexion, internal rotation, abduction, and adduction bilaterally. Positive Ober's and
168 Thomas tests bilaterally indicated decreased soft tissue mobility in the quadriceps and iliotibial
169 band musculature. Palpation of low back musculature revealed multiple and significant trigger

170 points that were painful to light palpation. SI examination and special tests were performed
171 following procedures described by Cook and revealed SI hypomobility and pain with palpation.¹³
172 A summary of tests and measures performed during initial examination and their results are
173 detailed in Table 2.

174 **Clinical Impression: Evaluation, Diagnosis, Prognosis**

175 The patient presented with signs and symptoms consistent with her medical diagnosis of
176 AS and her impairments included: decreased lumbar ROM and LE strength, hypomobile lumbar
177 vertebrae and SI joints, and tenderness to palpation of lumbar vertebrae and sacrum. Her medical
178 diagnosis was M45.7 (Ankylosing spondylitis of lumbosacral region) and PT diagnosis was
179 M54.16 (Radiculopathy, lumbar region).¹⁵ The patient's mobility and strength deficits impaired
180 her ability to manage ADLs and maintain a healthy, active lifestyle in a pain-free manner. She
181 continued to be an excellent candidate for a case report to explore best practice and influence
182 future decision making models for PT management of AS.

183 The patient's prognosis was determined to be fair due to the progressive nature of AS,
184 current presence and future risk of multi-system co-morbidities, and female gender, which was
185 associated with poor functional outcomes at two years following diagnosis ($p=.012$).¹⁶ Decreased
186 likelihood of poor outcomes and factors working in the patient's favor were that she was a non-
187 smoker, age was less than 33 years old, and previously received college-level education.¹⁶ The
188 patient was motivated to participate in PT to recover mobility, decrease pain associated with
189 joint and soft tissue restrictions, and preserve progression of her condition.

190 The patient received ongoing consultations with the referring rheumatologist for medical
191 management of her condition in addition to workup for diagnosis of a recent onset auto-immune
192 disorder. Re-evaluations of ROM, strength, pain, and function were planned every 30 days to
193 determine patient progress and need for alterations to the POC. Due to the patient's high medical

194 complexity, notes of all patient encounters were sent to the rheumatologist for review of the
195 patient's physical function and to ensure cohesive, coordinated, team-based care.

196 Planned interventions involved a multi-modal approach to include: therapeutic exercise
197 for strength, flexibility, and endurance, neuromuscular re-education for core engagement and
198 coordinated breathing, postural re-education for skeletal alignment and muscular balance,
199 manual therapy to relieve joint and soft tissue restrictions and provide neural symptom
200 management, modalities for pain management, and patient education for understanding and self-
201 care. Short-term and long-term goals for the patient are listed in Table 3.

202 **Patient Related Instruction, Coordination, Communication, Documentation**

203 The patient was educated about the pathology of her diagnosis, findings of the objective
204 examination, relevant anatomy and physiology, POC, and goals of PT. Planned intervention
205 involved 60-minute sessions provided two to three times per week for 8-10 weeks. The patient
206 received an initial home exercise program (HEP) with pictures and guidelines for frequency,
207 intensity, and duration of each exercise. At each session, the patient was asked about compliance
208 in performing the HEP, response to previous session, and current levels of pain and fatigue. All
209 episodes of care were documented and saved using an electronic medical record system with all
210 notes sent to the patient's referring rheumatologist.

211 **Procedural Interventions**

212 The patient began each 60-minute session with a dynamic warm-up of either recumbent
213 cycling or treadmill walking (determined by patient preference and tolerance) followed by
214 exercise interventions for flexibility, core engagement, strengthening, and dynamic control.
215 Sessions finished with soft tissue or joint mobilizations followed by electrical stimulation (e-
216 stim) with moist heat. At week 5, when therapy resumed after a medical event, soft tissue
217 mobilization was performed after dynamic warmup as it provided the greatest subjective

218 decrease in pain and improved activity tolerance. The patient was compliant with the prescribed
219 HEP and attended all scheduled sessions. No co-interventions were utilized besides
220 pharmacological management of her diagnosis. A weekly schedule of care is provided in Table
221 4. Specific interventions, parameters, and purpose of each intervention is provided in Table 5.
222 Prescribed HEP is provided in Appendix 2.

223 Therapeutic Exercise

224 Direction-specific therapeutic exercise and progressive endurance exercise were
225 recommended based on strong evidence to reduce symptoms, improve mobility, and encourage
226 health promotion.⁶ Flexion-specific exercises were utilized due to patient preference and were
227 recommended to assist opening of the foraminal and central canals to relieve compression of
228 spinal nerves and improve peripheral symptoms and spinal flexibility.⁶ Other therapeutic
229 exercises were selected with clinical judgment based on current impairments, known risks
230 associated with AS, and patient tolerance.

231 Neuromuscular Re-education

232 Trunk coordination, strengthening, and endurance exercises were recommended for
233 chronic low back pain based on strong evidence.⁶ Patients with AS were determined to be at
234 increased risk of poor cardiorespiratory fitness and decreased chest expansion thus utilizing
235 exercises for cardiorespiratory health were an important aspect of AS management.¹⁷

236 Postural Re-education

237 Postural re-education was utilized to increase trunk extensor strength to improve postural
238 alignment and muscle balance. Postural changes are a common characteristic of AS due to
239 structural changes that occur during progression of the disease. A study performed by Batur¹⁸
240 demonstrated postural changes due to AS could lead to balance problems thus postural and
241 balance exercises are appropriate and encouraged for this population.¹⁸

242 Manual Therapy

243 Non-thrust joint mobilizations, lumbar long axis distraction, and lumbar soft tissue
244 mobilizations were utilized to improve and preserve soft tissue and joint health as well as
245 manage neurological symptoms. The CPG for spinal stenosis recommends the use of manual
246 mobilizations in addition to exercise to improve patient recovery and intermittent lumbar traction
247 in prone may benefit patients who experienced nerve root compression with peripheralized
248 symptoms.⁶ A randomized control trial recommended the use of manual mobilizations to
249 improve function, disease activity, and pain levels and these effects were observed up to three
250 months after discharge.¹⁹ Of note, the American College of Rheumatology stated thrust
251 manipulation was contraindicated for patients with AS due to the potential for fracture or spinal
252 cord injury.⁵ Limited evidence was available regarding the effectiveness of massage therapy, and
253 suggested it may be an appropriate and effective intervention to reduce pain, fatigue, stiffness,
254 and need for pain medication while improving general function, spinal mobility, and
255 cardiovascular health by reducing heart rate and blood pressure.^{20,21}

256 Modalities

257 Interferential current (IFC) therapy combined with moist heat was provided to the low
258 back for the purposes of pain management and patient comfort. A study of patients with chronic
259 low back pain determined IFC provided significantly greater subjective and objective pain relief
260 compared to transcutaneous electrical nerve stimulation and high-voltage electrical stimulation.²²
261 A limitation to this study was those with rheumatic diseases were excluded, which would include
262 the patient in this report.²² The patient reported previous success with IFC for low back pain thus
263 patient values were considered while implementing this treatment.

264 Patient Education

265 The patient was educated regarding their diagnosis, relevant anatomy, prognosis, and
266 plan of care with physical therapy. Education regarding intervention purpose, self-management,
267 and patient concerns were provided each session. Level I evidence supported the
268 recommendation to educate patients with LBP regarding anatomy and pathology, expected
269 outcomes, appropriate exercise, and strategies for effective self-management.⁶

270 **Outcomes**

271 The patient's POC was altered due to health complications and inconsistent symptom
272 presentation throughout the episode of care. Prior to the planned re-evaluation date, the patient
273 presented to the emergency room with severe abdominal pain and was diagnosed with ruptured
274 ovarian cysts. Activity restrictions due to increased blood pooling required PT to be put on hold
275 until intervention was provided. The patient was put on activity restrictions for two weeks after
276 this diagnosis. When therapy resumed, treatment focused on pain management, stress
277 management, and breathing techniques due to increased pain levels and shortness of breath.
278 Treatment sessions consisted of soft tissue mobilization of the lumbar and cervical musculature
279 along with gentle breathing and relaxation exercises to promote diaphragmatic breathing and
280 stress reduction.

281 The patient was re-introduced to general activity and specific therapeutic exercises as
282 tolerance allowed. The patient consistently verbalized and demonstrated proper performance of
283 her HEP. Upon re-evaluation at seven weeks and 13 weeks, the patient demonstrated improved
284 active lumbar ROM, pain scale ratings, neural flexibility, LE strength, and single leg balance.
285 ODI scores demonstrated an initial preservation of function with a statistically significant decline
286 in function at 13 weeks indicating a severe level of functional limitation.¹⁰ Special tests for
287 lumbar and hip joint mobility remained unchanged and painful throughout the episode of care
288 (Table 6).

289 The patient also received pharmaceutical intervention throughout the episode of care.
290 During the second week of treatment the patient began a course of Cosentyx, an
291 immunosuppressant medication commonly utilized to treat AS by decreasing systemic
292 inflammation.²⁴ Remicade, an additional immunosuppressant medication utilized to treat AS by
293 acting as a TNF-inhibitor to prevent disease and allow diseased joints to heal,²⁵ was initiated the
294 seventh week of treatment. After initiation of each of these medications, the patient reported
295 symptoms and activity tolerance significantly improved compared to minor, short-lasting
296 improvements with PT interventions alone.

297 **Discussion**

298 A comprehensive approach of manual intervention, therapeutic exercise, neuromuscular
299 re-education, postural training, and modalities was used in the PT management of this patient.
300 Furthermore, a collaborative approach of PT, pharmaceutical, and medical intervention was
301 utilized and demonstrated the need for comprehensive, interprofessional care when treating a
302 patient with AS. Treatment during PT was provided according to the patient's daily presentation
303 to sustain patient-centered care focused on symptom management and preservation of physical
304 function to improve quality of life. The patient reported manual soft tissue mobilization and IFC
305 interventions seemed to provide the greatest degree of pain relief throughout the episode of care.
306 Thus, emphasis was placed on these interventions in addition to symptom-specific exercises to
307 target deficits and restore function. The patient reported pharmaceutical therapy, which included
308 the initiation of Cosentyx and Remicade, provided the most significant overall change in
309 symptom relief and function.

310 Two sessions of lumbar joint mobilization was provided in attempts to improve vertebral
311 mobility as patient symptoms were improving at the time of initiation. This intervention was
312 ceased the week after due to significant increase in pain and patient intolerance. While most of

313 the patient's goals were met during therapy, they did not seem to provide a clear depiction of her
314 progress and functional status due to the inconsistent and varied presentation she presented with
315 from week to week. This case report demonstrated the complex case management of AS as the
316 POC, intervention provided each session, and activity recommendations were consistently
317 adjusted due to medical necessity, objective clinical factors, and patient tolerance and preference.

318 A limitation to this case report was a lack of available evidence regarding PT
319 management of AS prior to this publication. The strength of evidence in similar patient
320 populations and clinical judgment guided treatment planning and intervention efficacy. The CPG
321 for lumbar stenosis recommended use of flexion-based exercises, lumbar distraction, and e-stim⁶
322 to which the patient demonstrated improvements in strength, neural symptoms, and significance
323 of pain. Determination of the outcome of treatment was also limited due to publication of this
324 case report prior to the patient's discharge from therapy. This episode of care demonstrated AS is
325 a complex diagnosis with evolving symptoms requiring patient-centered and collaborative care
326 with other medical professions.

327 Future clinicians may utilize a similar approach with other patients presenting with AS
328 but should recognize each case may present differently and thus should implement patient-
329 specific interventions based on best available evidence and patient response. Research and
330 development of a CPG for PT management of AS would be beneficial to provide consistent care
331 by educating clinicians the complex, evolving nature of AS and specific, evidence-based
332 interventions that would be appropriate and beneficial for this population. Research concerning
333 appropriate management for the differing stages of disease activity, whether they are in an active
334 or non-active inflammatory state, would also be indicated to assist clinical decision-making and
335 intervention efficacy for all patients with AS, regardless of clinical status.

336

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400
401

402 Tables and Figures

403 Table 1. Systems Review.

Cardiovascular/Pulmonary	Resting heart rate: 76 beats per minute (bpm) Resting blood pressure: 120/85 mmHg
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	Reported decreased endurance and increased general fatigue. Non-pitting edema present in bilateral knees and ankles.
Musculoskeletal	Impaired Posture: forward head, rounded shoulders, increased thoracic kyphosis, increased lumbar lordosis, anterior pelvic tilt Impaired ROM: decreased lumbar flexion, extension, and lateral flexion Impaired Gross Strength: decreased bilateral hip flexion and abduction, dorsiflexion, and plantarflexion Impaired Height/Weight: Body Mass Index > 25 (unexplained weight gain)
Neuromuscular	Parasthesia present in left lower extremity (LE) and occasionally right LE, altered reflexes, decreased sensation throughout left LE Gait impairments: decreased gait speed, decreased trunk rotation and arm swing, increased out-toeing of right LE, forward trunk lean
Integumentary	Not impaired
Communication	Not impaired
Affect, Cognition, Language, Learning Style	Language not impaired. History of anxiety, depression. Patient states difficulty with recall and occasional memory fog. Preferred learning style is written and/or demonstration.

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Table 2. Tests and Measures.

Lumbar ROM (active)	Value (cm)	
Flexion – fingertip to floor	10 cm, painful	
Extension – tape measure	4 cm, painful	
Left lateral flexion – fingertip to thigh	14 cm, painful	
Right lateral flexion – fingertip to thigh	7 cm, painful	
Left rotation	WNL, pain at end range	
Right rotation	WNL, pain at end range	
LE MMT (Myotome tested¹⁴)	Left	Right
Hip flexion (L2, L3)	4+, painful	4+
Hip extension	4+, painful	4+, painful
Hip abduction	4+, painful	4+, painful
Knee flexion	5	5
Knee extension (L2, L3, L4)	5	5
Dorsiflexion (L4)	5-, painful	5-
Great toe extension (L5)	5	5
Plantarflexion – unilateral (S1)	4/5	Unable to perform
Special Tests	Left	Right
SLR	Positive – 35 degrees	Positive – 36 degrees

Slump test	Positive	Positive
Lumbar distraction	Positive	Positive
Lumbar soft tissue palpation	Increased muscular tension, trigger points present, and tender to palpation throughout lumbo-thoracic multifidi, quadratus lumborum, and piriformis bilaterally.	
Lumbar joint mobility (Spring test)	Hypomobile (2/5) and painful CPAs and UPAs bilaterally L1-L5	
SI compression	Positive	
SI distraction	Positive	
SI bony palpation	Bilateral PSIS and sacral base tender to palpation.	
Gillet's test	Positive – hypomobile	Negative
Standing forward flexion test	Positive – hypomobile	Negative
Gower's sign	Positive	
Single leg balance screen, eyes open, firm surface	10 seconds x 2 trials (increased sway)	10 seconds x 2 trials
Thomas test	Positive	Positive
Ober's test	Positive	Positive
Prone knee bend	Positive	Negative
LE Sensation Screen (Dermatomal testing)	Findings	
L2-S1	Impaired sensation - decreased to dull touch in L2-S1 dermatomes of left LE	
Reflex (Spinal nerve root¹⁴)	Left	Right
Patellar (L2-L4)	1+	2+
Achilles (S1-S2)	3+	2+
Outcome Measures	Score	
Oswestry Disability Index (ODI)	32.00%	

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Table 3. Patient Goals.

Patient will demonstrate and perform home exercise program independently as prescribed. (Ongoing) – Goal Met
Patient will independently participate in Pilates and/or walk/bike 3x/week for at least 30-minute sessions to improve activity tolerance and cardiovascular endurance. (4 weeks) – Goal Not Met
Patient will report pain to be no greater than 5/10 and less than 3/10 for greater than 50% of the day on the NPRS to decrease need for pain medication to perform daily activities. (4 weeks) – Goal Not Met
Patient will demonstrate proper sitting posture with equal weight distribution between each lower extremity to improve posture and work tolerance. (4 weeks) – Goal Met
Patient will report symptoms centralize to the hip bilaterally with decreased frequency and duration to improve ability to perform ADLs with less symptoms. (10 weeks) – Goal Met
Patient will improve lateral flexion to 14 cm bilaterally and pain-free to demonstrate improved range and symmetry of motion to allow for better mobility with ADLs. (10 weeks) – Goal Met

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Table 4. Weekly Schedule of Care.

Intervention	Week												
	1	2	3	4	5	6	7	8	9	10	11	12	13

Therapeutic Exercise	x	x	x	x	PT on hold – medical complications			x	x	x	x	x
Neuromuscular Re-education	x	x						x	x	x	x	x
Postural Re-education			x	x		x	x	x	x			
Manual Therapy – Soft tissue mobilization	x	x	x	x		x	x	x	x	x	x	x
Manual Therapy – Joint mobilization			x	x								
Modalities	x	x	x	x				x	x	x	x	x

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411 **Table 5. Interventions.**

Intervention	Parameters	Purpose
Recumbent bicycle	Pt ^a did not tolerate at times – inc ^b hip pain	Dynamic warm up with flexion bias
Treadmill walking	Self-paced, 10 mins ^c	Dynamic warm up
Lumbar F/L/R ^d rollouts ²³ 	Seated, 85 cm swiss ball by TheraBand™ (Akron, OH), 10 sec ^e hold, 10x ea ^f direction	Improve lumbar flexibility and ROM ^g
Single knee to chest	Supine, self-overpressure, 2x30 sec holds ea side	Improve gluteal/low back flexibility
Piriformis stretch	Supine, self-overpressure, 2x30 sec holds ea side	Improve piriformis flexibility, decrease muscular tension
Hamstring stretch	Supine, SLR ^h position with strap around foot, 3x30 sec holds ea side	Improve hamstring flexibility
Lumbar rotations	Hook-lying, self-paced, 20x ea side	Improve lumbar mobility, decrease muscular tension
Quadriceps stretch	Prone with strap around ankle, 3x30 sec holds ea side	Improve quad flexibility, decrease anterior tilt
Child’s pose F/L/R	1 min hold ea with deep breathing	Decrease muscular tension, promote circulation and

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		relaxation
Cat/Cow	Quadruped, 20x	Improve spinal mobility
Alternating UE ⁱ lift	Quadruped, 10 ea with TrA ^j hold	Improve core recruitment and neuromuscular control
Alternating LE ^k lift	Quadruped, 10 ea with TrA hold	Improve core recruitment and neuromuscular control
Fire hydrants	Quadruped, 10 ea with TrA hold	Improve core recruitment and neuromuscular control
Clam shells	Sidelying, 20 ea, progressed to red TheraBand™ at distal thigh	Improve hip abductor strength
Bridging	Supine, 20 with TrA hold, progressed to bridge with resisted abduction using red TheraBand™ at distal thigh	Improve core recruitment, anterior pelvic tilt, abductor and gluteal strength/control
Step ups	Forward: 2x20, 6" step on TheStep™ (Marietta, GA) Lateral: 20 ea, 6" step on TheStep™ Each progressed to 8" step	Improve hip, gluteal strength during functional activity
Sidestepping	Green TheraBand™ around ankles, 2x20' laps ea direction	Improve hip abductor strength with core recruitment
Monster walks F/B ^l	Green TheraBand™ around ankles, 2x20' laps ea direction	Improve hip and gluteal strength with core recruitment
Wall squats	55 cm™ TheraBand™ swiss ball behind back for support, 3x10, pain-free ROM	Improve lower extremity strength and eccentric control
Calf raises	Standing, body-weight, bilateral, 2x20	Improve push off during gait
Rows	Standing, blue TheraBand™, 3x15	Improve trunk extensor strength and posture
Shoulder extension	Standing, blue TheraBand™, 3x15 with scapular squeeze	Improve trunk extensor strength, shoulder positioning, and posture
ER pullout	Standing, red TheraBand™, 20 with scapular squeeze and 3 sec holds at end range	Improve trunk extensor strength, shoulder positioning, and posture
Thoracic rotation	Sidelying, 2 ea x 60 sec holds at end range	Improve thoracic mobility, coordinated diaphragmatic breathing for stress reduction
Thoracic book openers	Sidelying, 10 ea direction	Improve thoracic mobility, coordinated diaphragmatic breathing for stress reduction
Soft tissue mobilization	Prone with knees flexed on bolster and pillows under stomach for comfort, rolling/trigger point/myofascial release of quadratus lumborum, lumbar paraspinals, gluteus maximus, gluteus medius, deep	Decrease muscular tension, improve soft tissue mobility, strong patient response with immediate subjective pain and stiffness reduction

	external rotators, piriformis and/or quadriceps pending pt presentation	
Joint mobilization	Prone with knees flexed on bolster and pillows under stomach for comfort, CPAs ⁿ and bilateral UPAs ^o L1-S1 ^p vertebrae, Grade I-II oscillations progressing to Grade III oscillations as appropriate	Grade I-II: pain relief Grade III: improve joint mobility and tissue stretch
Electrical stimulation Unit used: WinnerEvo by Richmar (Chattanooga, TN) Electrodes used: 2” round EcoTrode by Physio Tech (Richmond, VA)	Prone with knees flexed on bolster and pillows under stomach for comfort, IFC with fixed pulse rate, intensity to patient tolerance, 10 mins using four 2” round electrodes placed on paravertebral musculature of lumbar spine	Pain management
Moist heat	Used with electrical stimulation, placed on low back	Improve muscle relaxation, patient comfort

412 ^aPt, patient, ^binc, increased, ^cmins, minutes, ^dF/L/R, Forward, Left, Right, ^esec, seconds, ^fea, each, ^gROM, range of motion, ^hSLR, straight leg raise, ⁱUE, upper extremity, ^jTrA, transverse abdominus, ^kLE, lower extremity, ^lF/B, forward, backward, ^mcm, centimeters, ⁿCPAs, central posterior-anterior, ^oUPAs, unilateral posterior-anterior, ^pL1-S1, lumbar 1 to sacral 1 segments

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416 **Table 6. Outcomes.**

	Initial Evaluation (6/11)		Re-evaluation (7/31)		Re-evaluation (9/13)	
ODI Score	32.00%		32.00%		50.00%	
NPRS - LBP	1-10/10		5-10/10		0-6/10	
Lumbar ROM	Flexion: 10 cm (pain) Extension: 4 cm (pain) Left lateral flexion: 14 cm (pain) Right lateral flexion: 7 cm (pain)		11.5 cm 4.5 cm (pain) 14 cm 13 cm (pain)		WNL WNL 14 cm 14 cm	
SLR	Left: 35° Right: 36°		50° 48°		60° 72°	
LE Strength	Left	Right	Left	Right	Left	Right
Hip flexion	4+/5 (pain)	4+/5	5-/5	5/5	5-/5 (pain)	5/5
Hip extension	4+/5 (pain)	4+/5 (pain)	5-/5 (pain)	5-/5 (pain)	5-/5 (pain)	5-/5 (pain)
Hip abduction	4+/5 (pain)	4+/5	5-/5 (pain)	(5/5)	5-/5	5/5
Dorsiflexion	5-/5 (pain)	5-/5	5-/5	5-/5	5-/5	5-/5
Plantarflexion – unilateral	4/5	3/5	4/5	4/5	4+/5	4+/5
Single leg balance (eyes open, firm surface)	Left: 10 sec x 2 trials Right: 10 sec x 2 trials		8 sec x 2 trials 10 sec x 2 trials		15 sec x 2 trials 15 sec x 2 trials	
Reflexes	Left	Right	Not tested		Left	Right

Patellar	1+	2+		2+	2+
Achilles	3+	2+		2+	2+
Gower's sign	Positive		Negative		Negative
Special Tests			Left		Right
Slump test			Positive		Positive
Lumbar distraction			Positive		Positive
Lumbar soft tissue palpation			Increased muscular tension, trigger points present, and tender to palpation throughout lumbo-thoracic multifidi, quadratus lumborum, and piriformis bilaterally.		
Lumbar joint mobility (Spring test)			Hypomobile (2/5) and painful CPAs and UPAs bilaterally L1-L5		
SI compression			Positive		
SI distraction			Positive		
SI bony palpation			Bilateral PSIS and sacral base tender to palpation.		
Gillet's test			Positive – hypomobile		Negative
Standing forward flexion test			Positive – hypomobile		Negative
Thomas test			Positive		Positive
Ober's test			Positive		Positive
Prone knee bend			Positive		Negative
LE Sensation Screen (Dermatomal testing)			Findings		
L2-S1			Impaired sensation - decreased to dull touch in L2-S1 dermatomes of left LE		

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418 **APPENDICES.**

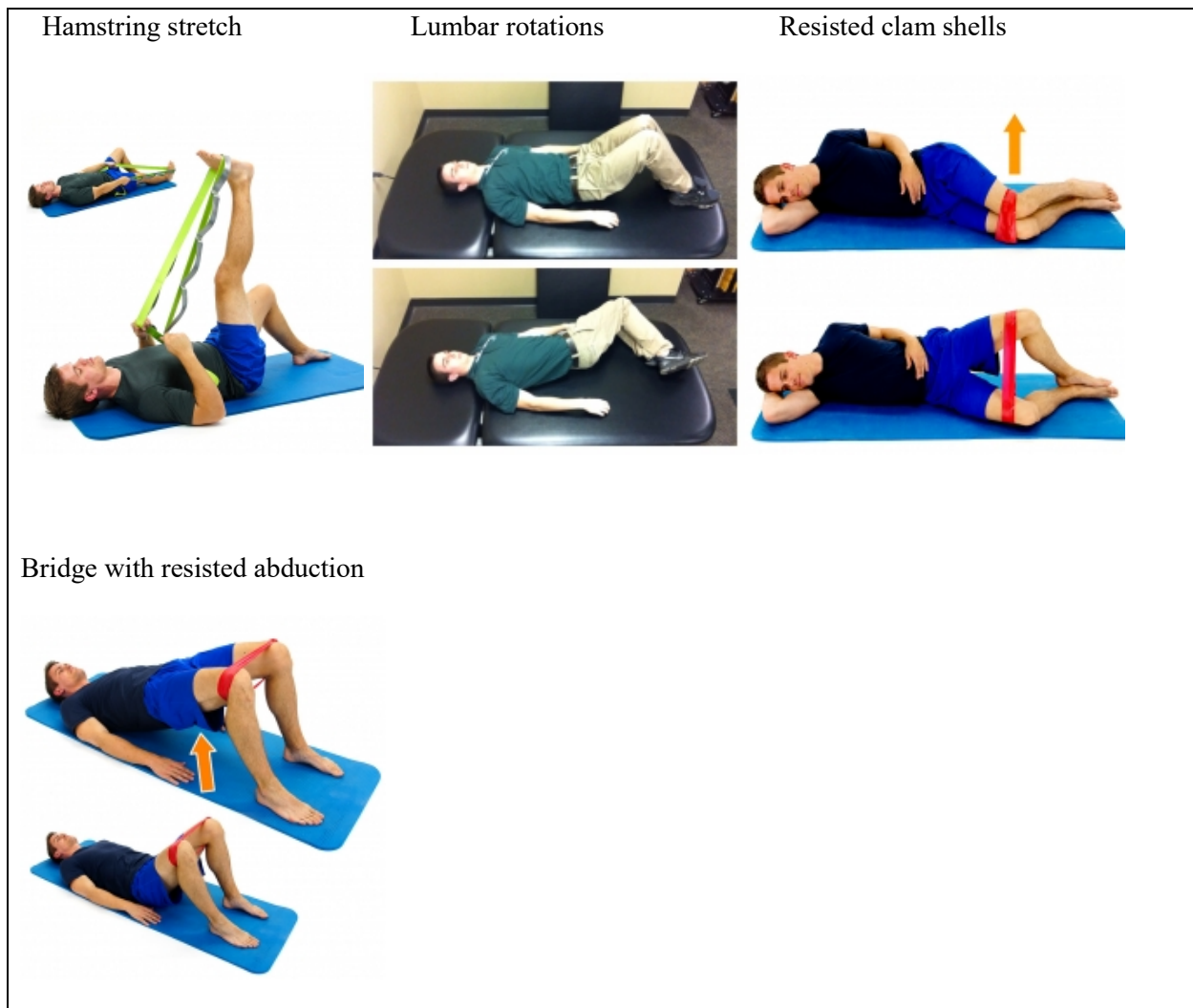
419 **Appendix 1. Medication List.**

Drug	Dosage	Prescribed Use
Ambien	10 mg / 1x nightly	Insomnia
Xanax	2 mg / prn	Anxiety
Vitamin D	50,000 IU / 1x weekly	Vitamin D deficiency
Methotrexate	2.5 mg / 1x daily	Immunosuppressant
Soma	350 mg / 4x daily	Muscle relaxant
Mobic	15 mg / 1x daily	Anti-inflammatory
Bupropion	150 mg / 1x daily	Depression
Cosentyx	300 mg / 1x weekly injection for	Immunosuppressant to reduce

Initiated June 18	5 weeks, then 150 mg / 1x monthly injection	inflammation
Remicade *Initiated July 25*		Immunosuppressant to reduce inflammation

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421 **Appendix 2. Prescribed Home Exercise Program.**



422 Images sources from HEP2go²³

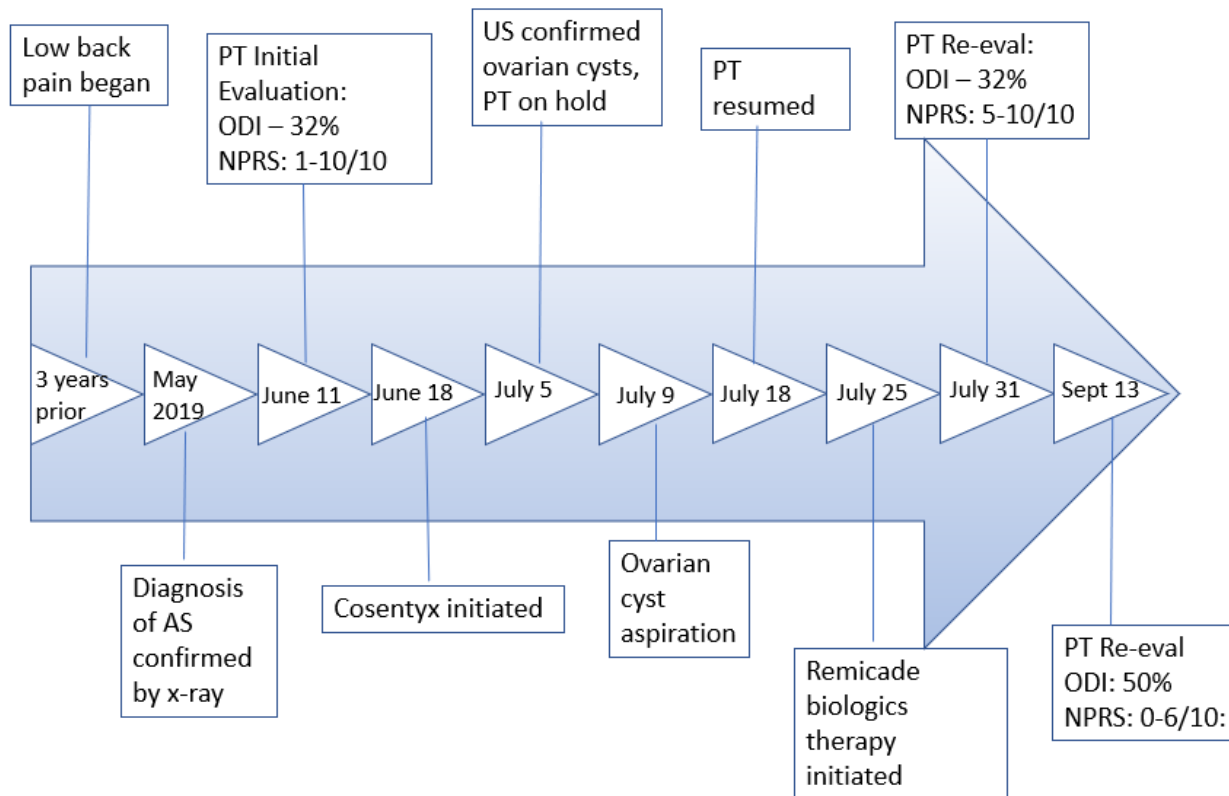
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TIMELINE

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428 **CARE Checklist**

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Final Parts One & Two, PTH708: Completed for the final submission to document the locations of key case report components.

CARE Content Area		Page
1. Title – The area of focus and “case report” should appear in the title		1
2. Key Words – Two to five key words that identify topics in this case report		2
3. Abstract – (structure or unstructured) <ul style="list-style-type: none"> a. Introduction – What is unique and why is it important? b. The patient’s main concerns and important clinical findings. c. The main diagnoses, interventions, and outcomes. d. Conclusion—What are one or more “take-away” lessons? 		3
4. Introduction – Briefly summarize why this case is unique with medical literature references.		4-5
5. Patient Information <ul style="list-style-type: none"> a. De-identified demographic and other patient information. b. Main concerns and symptoms of the patient. c. Medical, family, and psychosocial history including genetic information. d. Relevant past interventions and their outcomes. 		5-6
6. Clinical Findings – Relevant physical examination (PE) and other clinical findings		7-9, 18-19
7. Timeline – Relevant data from this episode of care organized as a timeline (figure		25

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or table).	
8. Diagnostic Assessment a. Diagnostic methods (PE, laboratory testing, imaging, surveys). b. Diagnostic challenges. c. Diagnostic reasoning including differential diagnosis. d. Prognostic characteristics when applicable.	9-10
9. Therapeutic Intervention a. Types of intervention (pharmacologic, surgical, preventive). b. Administration of intervention (dosage, strength, duration). c. Changes in the interventions with explanations.	10-13, 20-22, 24
10. Follow-up and Outcomes a. Clinician and patient-assessed outcomes when appropriate. b. Important follow-up diagnostic and other test results. c. Intervention adherence and tolerability (how was this assessed)? d. Adverse and unanticipated events.	13-14, 22-23
11. Discussion a. Strengths and limitations in your approach to this case. b. Discussion of the relevant medical literature. c. The rationale for your conclusions. d. The primary “take-away” lessons from this case report.	14-16
12. Patient Perspective – The patient can share their perspective on their case.	N/A
13. Informed Consent – The patient should give informed consent.	2, 5

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