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Effectiveness of Physical Therapy in an Elderly Man with Lyme Disease: A Case Report

Brittany Johnson
University of North Dakota

Effectiveness of Physical Therapy in an Elderly Man with Lyme Disease: A Case Report

by

Brittany Johnson
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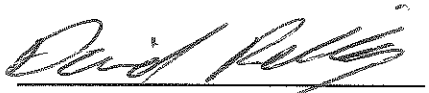
This Scholarly Project, submitted by Brittany Johnson in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Graduate School Advisor)



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Signature Brittany Johnson

Date 9-1-15

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ABSTRACT

Background and Purpose.

Lyme disease is the most prevalent tick-borne infectious disease in the United States and presents with symptoms that can be treated with physical therapy intervention. The purposes of this case report are to present (1) an example of physical therapy intervention as treatment for a 61 year old male diagnosed with late stage Lyme disease with multiple impairments; (2) to report the patient's functional outcomes; and (3) to provide basis for further research on the effects of physical therapy intervention as it relates to late stage Lyme disease.

Case Description.

The 60 year old, male patient was treated for a primary complaint of globalized weakness and inability to ambulate. Further impairments included deconditioning as a result of being bedridden for 4 weeks, gross muscle weakness, high fall risk, decreased functional mobility, pelvic fracture, migratory joint pain and arthritis, fatigue, incontinence, disturbed sleep patterns and benign paroxysmal positional vertigo (BPPV).

Intervention.

The patient was treated over the course of six weeks with physical therapy interventions which included: transfer training exercise, home exercise program, therapeutic exercise, manual therapy, and gait training.

Outcomes.

Patient showed a clinically significant increase in areas of strength, functional independence measure, functional mobility, transfer safety and technique, and ambulation distance.

Discussion.

This case report supplies evidence that physical therapy intervention can produce favorable outcomes following Chronic Lyme disease. Future research should include the use of various functional outcome assessments.

CHAPTER I

BACKGROUND AND PURPOSE

Lyme disease is a tick-borne infectious disease caused by the bacteria *Borrelia burgdorferi*.[1,2] The disease is only transmitted to humans (in the United States) through ticks of the *Ixodes* species including deer ticks or black-legged ticks.[1] Many other forms of the bacteria are found in other areas of the world including Europe, Asia and Australia.[1] Lyme disease is the most prevalent tick-borne infectious disease in the United States and is most often reported (90% of cases) in the mid-Atlantic, Northeastern, and North Central regions but has been reported in 49 states.[1] According to the Centers for Disease Control and Prevention (CDC), in 1995 they had confirmed 11,700 cases of Lyme disease compared to 29,959 cases in 2009.[3] The most common time of year to contract Lyme disease is during late spring and early summer due to a combination of tick nymphs[4] being most active and human outdoor activities increased after winter months. [1]

Burgdorferi is contracted by tick larvae by feeding on infected rodents.[1] The bacteria are passed from the larvae to nymphs and adult ticks as they develop.[1] Ticks are an external parasite meaning they need a host, the white-tailed deer, to live.[1] Nymphs (defined in Appendix 1) are 1-2mm in size, often attach to human skin in order to feed.[1] As the tick feeds it becomes engorged with blood and often falls off or is removed.[1]

However, if the tick is not removed, after 36 hours the *burgdorferi* bacteria is transmitted to the host through the saliva of the nymph.[1] An inflammatory response, presenting as the commonly seen bulls-eye rash called erythema migrans, occurs sometime between 3 and 32 days after contracting the bacteria.[1] If left untreated, the bacteria can survive for years in the human body by adapting and reducing immune system responses.[1] Lyme disease is a multisystem infection with "diverse cutaneous, arthritic, neurologic, [and] cardiac"[5p.1413] clinical manifestations.

Lyme disease has many different presentations, often presenting as other diseases, and symptoms may not begin to appear until one month after the initial transmission of the bacteria.[1] Therefore, Lyme disease is often misdiagnosed and is often untreated.[2] Lyme disease characteristically develops in three stages: stage one, the early localized stage; stage two, the disseminated infection; and stage three, the late persistent infection.[1] Stage one usually occurs within a few days of contracting the infection.[1] The most prevalent symptom is the erythema migrans which is present in 80%-90% of cases.[1,2] Other common symptoms that are present during the early stage are "fatigue, chills, fever, headache, lethargy, myalgias, or arthralgias".[1] Stage two occurs within days to weeks, once the bacteria have spread to the nervous system, cardiac system and musculoskeletal system.[1] Table 1 includes clinical manifestations of stage two, stage three and chronic Lyme disease. Stage three occurs weeks to months after the initial transmission of the bacteria.[1] Approximately 60% of individuals left untreated will develop stage three symptoms.[1] Intermittent arthritis is the most common clinical manifestation of stage three affecting large joints, such as knees, shoulders, elbows, ankles, hips, wrists and temporomandibular joints,[5] and can be monoarticular or

oligoarticular arthritis.[1,2] Arthritis generally occurs within six months of initial onset of Lyme disease.[5] The knee joint is the most common location of chronic arthritis, affecting 80% of individuals with Lyme arthritis.[5] Radiologic evidence has shown arthritis occurs unilaterally more often than bilaterally.[5] Despite antibiotic treatment, some individuals – 10% of adults and less than 5% of children[2] - may experience stage three symptoms classified as post-Lyme syndrome or chronic Lyme disease.[1]

Table 1. Clinical Manifestations of Lyme Disease[1]

Stage Two	*Stage Three*	*Chronic Lyme Disease*
Neurologic • Facial Nerve Palsy (Bell's Palsy) • Cognitive Impairments (forgetfulness, decreased concentration, difficulty with mentation) • Cranial neuritis • Encephalitis • Encephalomyelitis • Encephalopathy • Meningitis • Radiculoneuropathy • Mild headache • Stiff neck	*Neurologic* • Spinal radicular pain • Distal paresthesias • Mild encephalopathy • Cognitive disturbances	• Symptoms resembling fibromyalgia or chronic fatigue syndrome • Disabling fatigue • Severe headache • Diffuse muscle or joint pain (months to years) • Cognitive difficulties • Sleep abnormalities
Lyme Arthritis • Unilateral, large joints • Migratory musculoskeletal pain in joints, tendons, bursae, muscle and bone • Monoarticular arthritis • Oligoarticular arthritis	*Arthritis* • Intermittent, marked pain and swelling • Joint erosions • Permanent joint abnormalities	

Table 1. Clinical Manifestations of Lyme Disease[1] Continued

Stage Two *Cardiac* • Heart block • Dysrhythmia • Irregular, rapid or slowed pulses • Dizziness • Fainting • Shortness of breath		

Lyme disease is diagnosed using a blood test to test for antibodies present when the bacteria are alive in the human body.[1] Antibodies may not be present for up to 2 weeks after the infection, therefore a false negative can occur.[1] However, if erythema migrans is a symptom, treatment can occur without positive findings in the blood test.[1] Synovial fluid can also be tested to distinguish Lyme arthritis from other forms of arthritis.[1] Treatment for Lyme disease is oral antibiotics, most commonly doxycycline or amoxicillin, given for 14-21 days.[1] Symptoms lasting despite antibiotics may receive a second round of treatment, however if symptoms remain persistent data does not support the use of continued antibiotics.[1]

Early treatment is very effective for most people. Lyme disease is curable with antibiotic treatment and resolution of symptoms within a few weeks to months of treatment.[1] However, approximately 15% of people who undergo antibiotic treatment develop symptoms affecting cardiac, musculoskeletal and nervous systems.[1] Furthermore, as mentioned above, some individuals do not respond to antibiotic treatment.[2]

Chronic Lyme disease and untreated Lyme disease most commonly result in chronic arthritis as the most debilitating symptom.[1] The condition has been termed chronic because symptoms last over a period of a minimum of 3 months.[1] Individuals who have been recorded as having chronic Lyme disease have been reported as having relapsing arthritis and fatigue for up to 15 years.[6] Chronic Lyme disease is relatively unexplained.[1] The mechanism of chronic Lyme disease symptoms is unclear because there is no evidence that the chronic post-treatment symptoms are attributable to an ongoing infection with B.bugdorferi.[6] The spontaneous remission of symptoms is also very unclear in individuals with chronic Lyme disease but is attributed to the natural course of the disease.[7]

Physical therapy (PT) becomes an important part of rehabilitation including strengthening, gait training and range of motion exercises.[1] Caution must be taken with the condition of the joints and as to avoid overexertion commonly correlated with chronic fatigue and musculoskeletal pain that often occur.[1,8] Physical therapists must also perform frequent assessment of neurological function, cognition, level of consciousness and cardiac function, with any changes being reported to the physician.[1] Previous authors, Ellenbogen and Burrascano[9,10], have stated that physical therapy would be a necessary intervention for chronic symptoms resulting from Lyme disease, although no specific interventions are discussed. One case report by Moser[8], discusses the lack of research published about physical therapy management for Lyme disease and reports therapeutic exercise and gait training for a 14 year old girl. Physical therapy intervention has shown positive effects on the clinical manifestations of arthritis[11] and

fatigue[12]; therefore physical therapy intervention can be hypothesized to decrease symptoms associated with late stage Lyme disease.[8]

The purposes of this case report are to present (1) an example of physical therapy intervention as treatment for a 61 year old male diagnosed with late stage Lyme disease with multiple impairments; (2) to report the patient's functional outcomes; and (3) to provide basis for further research on the effects of physical therapy intervention as it relates to late stage Lyme disease.

This particular patient was selected for the case report due to his abundance of impairments, complexity of symptoms, magnitude of opportunities for use of examination techniques, remarkable improvement over the course of therapeutic treatment and lack of research on physical therapy as an intervention for late stage Lyme disease.

CHAPTER II

CASE DESCRIPTION

Prior to 2011, the patient was completely independent husband and lived with his wife in a single story home. The patient, a military veteran of the Navy for 4 years, was a heavy equipment operator in the mines where he drove truck for April nearly 40 years. Around this time, the patient began to experience symptoms consisting of stiffness, weakness and pain. He sought out medical attention in the Western United States (U.S.) and was diagnosed with Lyme disease. The patient was treated with antibiotics until his symptoms seemed to be managed, however, his symptoms returned and the patient was forced to quit his job due to his inability to function. The patient was started on another treatment of antibiotics, however his symptoms continued to worsen. He did not receive additional medical care such as physical therapy, occupational therapy or intensive care during this time. Over the next two years, the patient had an unexplained weight loss of 131 pounds (from 283 lbs. to 152 lbs). He went from being independent in the community to needing the use of a cane. The patient reported 9 falls during this time period.

The patient then experienced a fall that resulted in a superior and inferior rami pelvic fracture. The patient was seen in the emergency room in order to obtain this diagnosis and was instructed to be weight bearing as tolerated. Over the course of

these 4 weeks, the patient, relying on his wife for functioning, had been 100% bedridden due to a combination of pain, fear of falling and generalized weakness.

The patient was first seen in a western U.S. hospital four weeks following his last major fall, where he was treated for a primary complaint of globalized weakness and inability to ambulate. Further impairments included deconditioning as a result of being bedridden for 4 weeks, gross muscle weakness, high fall risk, decreased functional mobility, pelvic fracture, migratory joint pain and arthritis, fatigue, incontinence, disturbed sleep patterns and benign paroxysmal positional vertigo (BPPV).The patient's goals upon admission to the VA were to ambulate independently on level ground and stairs so that he could return to his home (six stairs, with no railing to enter) and be independent in the community.

History and Review of Symptoms

The patient was a 61 year old Caucasian male, whose primary language was English and education consisting of a high school degree and some college. The patient had been a smoker for 16 years, but had no other behavioral risk factors except for a recent sedentary lifestyle resultant from his pelvic fracture.

The patient's relevant past medical history consisted of nicotine dependence, general health deterioration, hearing loss, muscle pain, muscle weakness, hyperlipidemia, coronary arteriosclerosis, CABG 4 vessel, Lyme disease, and raised prostate specific antigen. Relative family history consisted of an extensive history of autoimmune disorders, including his sister with systemic lupus erythematosus.

The patient presented to physical therapy with the following vital signs: resting heart rate was 92 bpm, resting blood pressure was 110/80 mmHg, and oxygen saturation was 91%. Patient had good skin integrity but complained of soreness on his buttocks from prolonged sitting, however, there was no visible wound present in this area. The patient did have a naval hernia.

Examination

The patient, as many patients with Lyme disease do, had an array of symptoms and impairments. The examination and evaluation was very extensive during the initial visit and continued to evolve daily throughout the treatment. The patient's extensive examination and evaluation can be broken down into primary impairments including strength, range of motion (ROM), functional mobility, balance and gait/ambulation. The first impairment, and one of the primary complaints, was a decrease in strength which was tested using manual muscle testing (MMT). MMT has been shown to be reliable for both interexaminer reliability (82-97%) and for test-retest reliability (96-98%).[13] MMT has also shown to be valid when compared to a "gold standard" such as electromyography (EMG) or dynamometer testing.[13] The patient was tested for gross muscle weakness in multiple muscle groups using MMT (5/5 scale). The results are listed below in Table 2. Primary areas of weakness were found in proximal muscle groups of both the upper and lower extremities with more involvement of the lower extremities. Furthermore, as a result of generalized muscle weakness, the patient had many secondary impairments which are listed in Table 3. Table 4, found in the Appendix 2, has specific findings of pelvic floor exam.

Table 2. Muscle Testing Results upon Initial Examination

Motion	Left	Right
Hip Flexion	3/5	3/5
Hip ER	3+/5	3+/5
Hip IR	4/5	4/5
Hip Abduction	4-/5	4-/5
Hip adduction	4+/5	4+/5
Double Leg Bridge	Can clear approximately 4" off mat table	
Single Leg Bridge	Unable to clear mat table bilaterally	
Knee Extension	4/5	4/5
Knee Flexion	4/5	4/5
Ankle DF	4/5	4/5
Ankle Inversion	3+/5	3+/5
Ankle Eversion	4/5	4/5
TA contraction	+	+
Mini Crunch	Able to reach 1" above superior border of the patella	
Shoulder Flexion	4+/5	4+/5
Shoulder Extension	4+/5	4+/5
Shoulder IR	4+/5	4+/5
Shoulder Adduction	4+/5	4+/5
Shoulder Abduction	4-/5	4-/5
Shoulder ER	4-/5	4-/5
Elbow Flexion	5/5	5/5
Elbow Extension	4+/5	4+/5
Elbow Supination & Pronation	4+/5	4+/5
Wrist Ulnar deviation	4/5	4/5
Wrist Flexion/ Extension	4+/5	4+/5
Finger Abduction	4/5	4/5
Grip strength	20 lbs	20 lbs
Key Pinch	10 lbs	10 lbs
3 Jaw Chuck	8 lbs	8 lbs
All Lumbar RIMs	Strong and Pain free	

ER: External rotation, IR: internal rotation, DF: dorsiflexion, TA: Transverse Abdominis, RIMS: Resisted Isometric Movements

Table 3. Secondary Impairments as a Result of Weakness

Secondary Impairment	Test/Measure
High Fall Risk	Obtained from history
9 Previous Falls	Obtained from history
Pelvic Fracture	History/Plain film x-ray
Incontinence	Pelvic Floor Exam: MMT: Puborectalis and right pelvic floor weakness

The patient's ROM was tested using observation of active range of motion (AROM) of both upper extremity (U/E) and lower extremity (L/E) in all planes. AROM showed limitations in left knee extension (0-5 degrees); ankle dorsiflexion (0 degrees) bilaterally; shoulder elevation (limited bilaterally with tissue stretch end feel); and cervical extension (significantly limited), bilateral side-flexion (moderately limited) and bilateral rotation (moderately limited). Decreased cervical and shoulder ROM was consistent with the patient's forward head and kyphotic posture. Functional range of motion (Table 5) and special tests (Table 6) were used to further asses the patient's range of motion.

Table 5. Functional Range of Motion

Don and doff socks	Unable to perform
Sitting, place foot on opposite knee	Unable to perform bilaterally without use of upper extremities
Reach to opposite spine of scapula	Able to perform bilaterally
Reach to lower thoracic spine	Able to perform bilaterally

Table 6. Special Tests for Limited Range of Motion

Test/Measure	Result	Sensitivity	Specificity	Likelihood Ratio
90-90 Straight leg raise[14]	Positive for hamstring tightness: Right leg: 38 degrees knee flexion at 90 degrees hip flexion Left leg: 55 degrees knee flexion at 90 degrees hip flexion	.68	.56	1.5
Thomas Test[15]	Positive Bilaterally	.89	.92	11.13

The patient's functional mobility was significantly limited. He required significant use of his upper extremities, such as to pull himself into a more upright sitting posture while in his wheelchair or to lift his lower extremities to clear his foot when the PT moved the footrests of the wheelchair. The patient also demonstrated many improper and unsafe transfer techniques and showed extensive weakness and lack of confidence during the evaluation. Transfers from his wheelchair to the mat table required minimal assistance (MIA) using a pivot transfer and both of his upper extremities for assistance. From there, the patient was not able to control a stand to sit. He was able to sit with his back unsupported and feet flat on floor but did use his upper extremities for support. The patient independently performed unsafe sit-to-supine and supine-to-sit transfers, and required moderate assistance (MOA) during sit to stand.

The patient's balance was tested in sitting and standing to determine a baseline for any impairments. These results are listed in table 7. In conjunction with poor balance, the patient complained of dizziness. Dizziness can impact a person's balance, therefore, multiple tests were performed to determine the cause of dizziness to see if this impairment could be treated with physical therapy intervention (Table 8).

Table 7. Balance Testing

Sitting Balance: Lean outside base of support (BOS)	Able to achieve nose over outer thigh, bilaterally
Sitting Balance: Within BOS	Able to tolerate perturbations in all directions
Standing Balance: WBOS, SBA	30 seconds
Standing Balance: NBOS, SBA	10 seconds
Standing Balance: Single leg stance	.5 seconds bilaterally

WBOS: wide base of support, SBA: stand by assistance, NBOS: narrow base of support

Table 8. Tests to Determine Likely Cause of Dizziness

Test/Measure	Result	Sensitivity	Specificity	Likelihood Ratio
Lying-to-Sit Orthostatic Hypotension Test[16]	Negative	Not Standardized		
Cranial Nerve Testing[17]	- Reduction in upper quadrant peripheral vision but responded appropriately to pupillary light reflex (CN II) - Lack of appropriate accommodation but no nystagmus, pupils round and reactive to light (CN III) All CN tested and ruled out for involvement	N/A: neurological assessment		
Vertebral Artery Test[18]	Negative bilaterally	0	.67-.9	0
Dix-Hallpike Test[19]	Positive, left and right for posterior semicircular canalithiasis, paroxysmal positional vertigo	.79	.75	3.17

Ambulation was significantly limited upon initial examination as the patient was unable to ambulate independently. He walked 30 feet in parallel bars with stand-by assistance (SBA) and was limited due to pelvic pain. The Functional Independence Measure (FIM) was given to the patient as a baseline for functional independence. The FIM has been tested on the geriatric population and "indicates how much assistance is required for the individual to carry out activities of daily living".[20] The FIM is scored in sections, with a low score more dependent and a high score being more independent.[20] The PT department filled out the category of locomotion while the other medical staff

filled out other sections of the assessment. A few days later, the patient was moved from acute care to long term care, and the assessment was given at this time. Results can be found in table 9.

Table 9. Functional Independence Measure Results

Category	Section	Score	Description
Locomotion	Walk, Wheelchair	2/7, Maximal Assistance	Unable to ambulate 50 feet with FWW and SBA of 1 person
Locomotion	Stairs	1/7, Total Assistance	Did not occur

Further examination revealed that neurological involvement was found to be negative. All upper and lower extremity dermatomes were equal bilaterally to light touch. Lower extremity reflexes could not be elicited bilaterally. Upper extremity reflexes were not tested.

Evaluation

There is currently no standard diagnostic criterion for Lyme disease. Physical therapy evaluative techniques for the diagnosis of Lyme disease have not been identified; therefore with the patient reported diagnosis of Lyme disease and confirmation of medical records a screening was performed with this patient to determine multiple impairments and the level of impairments.

Assessment of the patient was as follows: The patient presented with WNL vital signs at rest and significant kyphotic and forward head posture. He had history of

disrupted sleep, weight loss, Lyme disease and a history of 9 falls, of which the last fall consisted of a right pelvic fracture. Since his last fall, 4 weeks prior to admission to PT, the patient had become immobilized due to pelvic pain and fear of falling. He presented with global weakness of upper and lower extremities, lower extremities more significant compared to upper extremities. Patient had decreased balance in sitting and was unable to ambulate independently but could ambulate 30 feet in parallel bars with assistance from the PT, and needed rest due to pelvic pain. The patient was limited in transfer skills including unsafe sit-to-supine and supine-to-sit, MIA pivot transfer from wheelchair to mat table, MOA sit-to-stand and locomotion as determined by the FIM to be MOA and TOA. The patient did not present to PT with any significant findings consistent with neurological involvement, orthostatic hypotension, cognitive deficits, or vertebral artery deficits. The patient's cranial nerve testing revealed all cranial nerves intact. He presented with positive tightness in hip flexors, hamstrings and calf muscles. He also presented with positive findings indicating BPPV of both right and left posterior canals. The patient also had findings consistent with urinary residual volume and fecal incontinence. His immediate needs were safety in transfers, reduction of falls by working toward strength gains, and safe independent locomotion. Other needs consisted of return to independent activities of daily living (ADLs), independence in home and community, as well as treatment for BPPV, and strengthening of pelvic floor for reduction of urinary and fecal incontinence.

Diagnosis

The medical staff at the hospital, upon admittance, were concerned the patient had been misdiagnosed so the patient was taken off antibiotic therapy and many tests were performed during the duration of the patient's stay. The following medical tests were performed to help determine a proper diagnosis: C-Spine MRI, paraneoplastic panel (blood, urine and cerebrospinal fluid analysis), antibody screening for autoimmune disease, muscle biopsy, 24 hour chemical urinalysis, HIV testing, prostate biopsy, CT of pelvis and abdomen, colonoscopy, EMG, and X-rays. After a multitude of testing, the patient's symptoms were unable to be explained by any other pathology and the diagnosis remained consistent with Lyme disease.

A PT diagnosis of ICD-9 088.81: Infectious and Parasitic Diseases, was consistent with idiopathic globalized muscle weakness of both upper and lower extremities, lower being more involved. No significant upper motor neurological symptoms were found.

Prognosis and Plan of Care

Upon admittance to the facility, prognosis was guarded as the cause of the gross muscle weakness was initially undetermined and if this was a type of progressive disease or not was unsure. Upon admittance to the VA, the patient was in need of many different assistive devices in order to be safe and independent at home including hospital bed, shower chair, commode, urinal, walker, reacher etc. However, as the patient progressed, his need for equipment decreased and the patient showed more

independence in his abilities to perform ADLs without assistance. The patient's goals were as follows:

1) Following PT intervention, the patient will be independent in bed mobility and demonstrate home exercise program (HEP) for decreased risk of impairments associated with bed-bound immobility (to be met within 2 weeks).
2) Following PT intervention, the patient will be able to perform supine-to-sit in a safe, efficient, and consistent manner in order to allow him to position appropriately in bed for eating (to be met in 2 weeks).
3) Following PT intervention, the patient will be able to perform sit-to-supine in a safe, efficient and consistent manner in order to allow him to lie down safely for sleeping (to be met in 2 weeks).
4) Following PT intervention, the patient will demonstrate 10 independent sit-to-stands for increased safety during transfers (to be met within 4 weeks).
5) Following PT intervention, the patient will demonstrate safe and independent transfers from his bed to w/c, w/c to bed, w/c to chair and chair to w/c for increased safety and independence to get to the bathroom (to bet met within 4-6 weeks).
6) Following PT intervention, the patient will be able to ambulate 150 feet with or without an assistive device, so that he may ambulate within his home safely (to be met in 12 weeks).

7) Following PT intervention, the patient will be able to ambulate up and down at least 1 flight of stairs with or without an assistive device in order to get into his home with six stairs and no railing (to be met within 12 weeks).

The patient's plan of care consisted of daily treatment for 8-12 weeks. Patient was to be seen for strengthening, flexibility, stability, balance and gait training for increased independence and safety in bed mobility, transfers, education in use and safety of appropriate assistive devices and ambulation for advancement toward long term goal (LTG) achievement and return to home independent or modified independent and safe in ADLs. The medical staff at the facility, including physical therapy, nutrition, smoking cessation, occupational therapy, restorative therapy, nursing and multiple physicians were all working together to help achieve these goals. Patient was seen on a daily basis so interventions were initiated, progressed and changed daily depending on the immediate needs of the patient that particular day, while focused on achieving LTGs.

Intervention

The patient was seen for multiple weeks and progressed quickly through the many exercises that he was prescribed. For convenience, the exercises have been grouped together in the same manner as the impairment tables. During the first couple of weeks, primary focus was placed on transfer training during therapy, as well as, teaching an exercise program that would help the patient get stronger while he was in the hospital. Patient's home exercise program started with basic exercises that the patient was able to perform while in his hospital bed. The patient, during the initial

weeks at the hospital, was unsafe to transfer and ambulate on his own. These exercises became an important part of his rehabilitation. The repetitions and sets were chosen for the purpose of trying to avoid fatigue as this is often a symptom associated with Lyme disease.[1]

Table 10. Transfer Training Exercises

Exercise	Education	Repetitions
Log roll	Proper mechanics	(week 1)
Side-lying to Sit	Proper mechanics	MIA X 5 (week 1)
Sit-to-stand	Proper mechanics and positioning, phases of standing, demonstration	MIA X 10 (week 2) SBA X 10 (week 2) Independent X 5 (week 2) Independent X 10 (week 4) Independent without use of U/E X 5 (week 4)
Pivot transfer from mat table to wheelchair	Proper mechanics, safety regarding footrests and wheelchair placement	1 person MIA (week 1) SBA (week 2) Independent (week 3)

MIA: minimal assistance, SBA: stand by assistance, U/E: upper extremities

Table 11. Home Exercise Program

Exercise	Purpose	Repetition
Quadriceps Sets	Quad strengthening	10 repetitions, 5 sets daily (week 2)
Heel slides	Hamstring strengthening	10 repetitions, 3 sets daily (week 2)
Ankle pumps	Reduction of Deep Vein Thrombosis	30 repetitions, 3 sets daily (week 2)
Heel cord stretch with sheet	Increased Dorsiflexion	3 repetitions, 30 seconds each, bilaterally (week 2)
Bridges	Increased gluteus maximus strength, activation for ambulation, weight bearing of L/E in preparation for gait	10 repetitions, 3 sets daily (week 1)
Abdominal crunches	Core strength for sitting balance and improved stabilization during ambulation	10 repetitions, 3 sets daily (week 1)

Throughout the course of treatment various therapeutic exercises were used to progress the strength of the patient in order to increase stability and for preparation for ambulation. The patient was briefly re-evaluated on a day to day basis and interventions were carried out accordingly per patient report of increased areas of pain and fatigue level. Progression of interventions were utilized as the patient was able to tolerate while working towards LTGs. Throughout the progression of exercises, mat table exercises were sometimes chosen over exercises in the standing position as to avoid excess pain associated with the pelvic fractures. These exercises can be found in table 12.

Table 12. Therapeutic Exercises

Exercise	Sets X Repetitions	Timeframe
Bridges	2 X 10 2 X 10 To fatigue 10 reps, 5 seconds holds, on large balance disc 10 reps, 5 second holds, on bosu ball with perturbations	Week 1 Week 2 Week 5 Week 5 Week 5
Short Arc Quads	2 X 10 bilaterally 2 X 10 bilaterally 3 X 10 bilaterally, 10# 3 X 10 left, 20# (right limited to pelvic pain)	Week 1 Week 2 Week 4 Week 4
Straight Leg Raise	2 X 10 bilaterally	Week 1
Side-lying clamshells	2 X 10 bilaterally, no resistance 2 X 10 bilaterally, yellow theraband 3 X 10 bilaterally, red and green theraband	Week 1 Week 1 Week 4, 5
Supine clamshells	1 X 10, yellow theraband 2 X 10, yellow theraband	Week 1 Week 2
Supine snow angels (bilateral hip abduction)	To fatigue, yellow theraband	Week 4

Table 12. Therapeutic Exercises Continued

Seated hip flexion	1 X 10 bilaterally 3 X 15 bilaterally 2 X 15 bilaterally, 3#	Week 1 Week 2 Week 4
Seated hip external rotation (ER)	2 X 10 bilaterally, yellow theraband	Week 1
Long arc quads over edge of bed (EOB)	2 X 15, 3# bilaterally	Week 4
Shuttle exercises	1 X 10 double leg extension, 4 bands 1 X 10 double leg extension, 6 bands 1 X 10 single leg extension bilaterally, 3 band 3 X 15, double leg extension, 5 bands 3 X 15, heel raises, 5 bands	Week 4 Week 4 Week 4 Week 5 Week 5
Quadruped hip extension	2 X 10	Week 5
Sidestepping	To fatigue, yellow theraband	Week 5
Narrow base of support (NBOS) stance	30 seconds, flat solid ground 2 X 3 minutes on trampoline 2 X 3 minutes on trampoline with head motions	Week 3 Week 3, 4 Week 4
Rowing	3 X 15, yellow tubing	Week 2
Rickshaw	3 X 15, 20# 3 X 15, 25# 2 X 15, 40# 3 X 15, 40#	Week 2, 3 Week 4 Week 4 Week 5
Bicep curls	2 X 15, 5# bilaterally	Week 4
NuStep	X 15 minutes X 10 minutes Education for independent use	Week 3 Week 5 Week 5
Heel cord stretch on slant board	3 X 30 seconds, bilaterally	Week 2, 5

Over the course of treatment, very little manual therapy was used with the patient. However, some was used with stretching of hamstrings and hip flexors. These stretches played an important role in maintaining normal ambulation. These can be found in table 13. Table 13 also shows the manual therapy used during the Epley maneuver to treat the patient's BPPV.

Table 13. Manual Therapy

Exercise	Repetition	Timeframe
Static hamstring stretch	Contract-relax X 4 10 second contractions, followed by 1 static 30 second stretch	Week 2
Static hip flexor stretch	2-3 X 30 seconds bilaterally	Week 2, 5
Epley Maneuver	Right posterior Canal Left posterior canal	Week 4 Week 5

A large part of this patient's physical therapy consisted of gait training. The focus for both the physical therapists and the patient was returning to independent ambulation in the home and community. Below, in table 14, gait training exercises are listed.

Table 14. Gait Training

	Duration	Timeframe
Ambulation, parallel bars	CGA, 30 feet, terminated due to pelvic pain SBA, 60 feet, terminated due to fatigue	Week 1 Week 1
Ambulation FWW	CGA, 50 feet CGA, 60 feet SBA, 100 feet (I), 160 feet (I), 400 feet, terminated due to pelvic pain (I), 300 feet, 3 minute rest break, 300 feet	Week 1 Week 2 Week 2 Week 2 Week 3 Week 5

Table 14. Gait Training Continued

Ambulation	CGA, 8 feet, terminated due to pelvic pain SBA, 20 feet	Week 2 Week 3
Restorative therapy	SBA, walking with FWW to and from meals	Week 2
Stairs	Up and down 4 steps, 2 rails, 1 step at a time X 1 Up and down 4 steps, 2 rails, reciprocal steps X 2 Up and down 4 steps, 1 rail, reciprocal steps X 1 Up and down one flight of stairs, reciprocal steps, one hand rail Up and down once flight of stairs, X 3, reciprocal steps, one handrail Up and down 5 steps, no hand rail, reciprocal steps	Week 4 Week 5 Week 5 Week 5 Week 5 Week 5

CGA: contact guard assistance, SBA: stand by assistance, (I): independent, FWW: front wheeled walker

Outcomes

Following 6 weeks of therapy the patient was reassessed. The following information is indicative of the outcomes that were achieved up to that point. Gross muscle strength was re-evaluated using manual muscle testing and showed improvement in multiple areas. The patient showed slight increase in hip flexion strength and hip external rotation (ER) strength bilaterally. He demonstrated unchanged strength testing in hip abduction, adduction and internal rotation (IR) bilaterally. Patient improved glute strength by demonstrating increased ability to clear mat table during double leg bridge and single leg bridge. Patient improved quadriceps and hamstring strength by ½ - 1 grade from initial evaluation 6 weeks prior. Patient showed an

increase in ankle DF strength by 1 grade, no change in inversion strength and a decrease in eversion strength by ½ - 1 grade. Patient increased his abdominal strength reaching to the inferior border of the patella compared to reaching 1" above the superior border of the patella 6 weeks prior. Patient showed great strides in U/E strength as patient's strength improved to WNL (5/5) in all U/E motions with the exception of shoulder flexion, shoulder abduction and shoulder ER. Grip strength did not improve to WNL over the course of 6 weeks but did improve by 15 lbs bilaterally. Patient demonstrated a decrease in strength with both key pinch and 3 jaw chuck grip strength testing. The results are also shown in table 15 below.

Table 15. Muscle Strength Testing at Six Weeks

Motion	Left	Right
Hip Flexion	4/5	4/5
Hip ER	4-/5	4/5
Hip IR	4+/5	4/5
Hip Abduction	4-/5	4-/5
Hip adduction	4+/5	4+/5
Double Leg Bridge	Can clear approximately 6-8" off mat table	
Single Leg Bridge	Clear 2" on right, 4" on left	
Knee Extension	5/5	5/5
Knee Flexion	4+/5	4+/5
Ankle DF	5/5	5/5
Ankle Inversion	3+/5	3+/5
Ankle Eversion	3/5	4-/5
TA contraction	+	+
Mini Crunch	Able to reach inferior border of the patella	
Shoulder Flexion	4+/5	4+/5
Shoulder Extension	5/5	5/5
Shoulder IR	5/5	5/5
Shoulder Adduction	5/5	5/5
Shoulder Abduction	4-/5	4-/5
Shoulder ER	4+/5	4/5
Elbow Flexion	5/5	5/5
Elbow Extension	5/5	5/5

Table 15. Muscle Strength Testing at Six Weeks Continued

Elbow Supination & Pronation	5/5	5/5
Wrist Ulnar deviation	5/5	5/5
Wrist Flexion/ Extension	5/5	5/5
Finger Abduction	5/5	5/5
Grip strength	35 lbs.	35 lbs.
Key Pinch	7 lbs.	6 lbs.
3 Jaw Chuck	5 lbs.	4 lbs.
All Lumbar RIMs	Strong and Pain free	
All Cervical RIMs	Strong and Pain free	

ER: external rotation, IR: internal rotation, DF: dorsiflexion, TA: Transverse abdominis, RIMs: resisted isometric movements

Functionally the patient is able to touch his feet and can don and doff footwear independently, improved from inability to do this 6 weeks prior. He was able to achieve figure four position in sitting without the use of his U/E. The patient's lateral balance in sitting was measured to be eight inches lateral of his thigh bilaterally, an improvement of eight inches. The patient was safe and independent in sit-to-stand using U/E, stand-to-sit, sit-to-supine and supine-to-sit. The patient was able to propel himself in his wheelchair. He was able to walk independently with a four wheeled walker. The patient was able to walk 200 feet with CGA without an assistive device. FIM score following six weeks was as follows: locomotion: walk, wheelchair, scored a six Modified Independence, as the patient is able to ambulate greater than 150 feet but uses either a walker or CGA for safety concerns. The patient's score for locomotion: stairs was a six, modified independence, as the patient is able ambulate one flight of stairs but uses the handrail for support. He was also negative for BPPV to the right, positive to the left.

The patient's immediate response to treatment varied. Depending on the intervention, the patient often times presented with increase fatigue and needed frequent rest breaks. However, overall the patient responded well to treatment at this point showing improvement in strength deficits, ability to transfer and gains in independent mobility. Patient was very compliant throughout treatment, performing his exercises diligently as he continually stated he could tell he was getting stronger, he was less afraid of falling and he wanted to go home.

CHAPTER III

DISCUSSION

After working with this patient for six weeks, the patient made gains towards long term goals with focus on increasing strength in U/E and L/E. The patient improved most areas of strength by ½ to 1 grade over the course of six weeks. He also made great strides in advancing his mobility including ability to demonstrate nearly independent mobility without an assistive device, and independent mobility with a four wheeled walker. He also demonstrated a decrease in pelvic pain that was evident by the increased ability to ambulate longer distances without an increase in pelvic pain. The patient also demonstrated a positive response to the Epley Maneuver treatment for BPPV as he reported a significant decrease in dizziness following treatment.

Clinically, this case report is important in reporting some of the long term effects that may be associated with Lyme disease. This case report supplies evidence that physical therapy for strengthening and gait training can produce favorable outcomes following Chronic Lyme disease.

This study is limited by the lack of measureable outcome scales. Upon more experience with outcome assessments, more measureable outcome scores would have been helpful in showing improved symptoms such as a pain scale, Berg Balance assessment or the Mini-BESTest, as well as, a falls efficacy scale. Other limitations include the severity of symptoms present with this patient, as well as, the multitude of

symptoms that are not directly associated with Lyme disease itself, but were rather secondary impairments from the primary impairments. For future studies, it is recommended using more outcome assessment scales. Also note that there is limited research on the impact physical therapy can have on Lyme disease. With that noted, future research and studies will be needed to gain more knowledge on the topic.

Reflective Practice

Reflecting back onto this case, I have learned a significant amount. I have learned that there are some things that just must be learned from experience. Each patient we treat provides new and additional information for us to be able to treat the next person even better. When I reflect back on this case, there are things I would do differently, knowing the things I know now. During my history, I would have asked more questions as to why the patient was bedridden for so long. I would have asked him about his fears of falling. I would have asked him about possible abuse or neglect because of the unexplained weight loss, completely bedridden, and the length of time before being brought to physical therapy. I would have asked him questions that could have helped me determine the extent of his deconditioning.

During the examination I would have focused less on the details and more on the large picture. I would have done more functional testing and less manual muscle testing of individual muscles. I would have provided more functional outcome measures to gather more information. I would have given the patient the falls efficacy scale to try and discern how much of his immobility was consistent with a fear of falling, but would have also continued to use the Functional Independence Measure, a functional assessment

tool, to show his abilities in ambulation. However, another functional assessment that could have been useful was one to test transfer abilities. I would have chosen to give him a test to determine his balance such as the berg balance or the mini best test, so that I could have had a baseline. Using these assessments could have shown progress in multiple areas.

Throughout my plan of care, I would have focused more on functional tasks and abilities, rather than trying to strengthen specific muscle groups. Working toward functional tasks would have provided him with opportunities to build strength in a more functional manner and could have possibly shortened his length of stay in the hospital. I would have supplemented these functional activities with a more vigorous home exercise program that the patient could tolerate. I believe that over time, experience will help to guide me in an appropriate direction regarding each individual patient.

In my case report, there are areas that could have used more research to back them up, such as alternate positions that prepare a patient for ambulation while decreasing pelvic fracture pain. I would go back and research his specific pelvic fracture and see what research is out there for strengthening the muscles of the pelvis, abdomen, back and lower extremity to ensure strength for decreased pelvic pain as well as increased ambulation and reduction of falls. Other areas that would have been good to research would be specific intervention techniques, such as repetitions and durations, time of day and types of activities in regards to fatigue.

The hospital has really great resources and so I believe that I utilized a wide variety of medical personnel including nursing, occupational therapy, nutrition, smoking cessation, and restorative therapy to help him make the best recovery. One area that

could have been touched on more could have been the psychological aspect of his condition. Referring him to someone in this professional area may have been beneficial. Another area that could have helped this patient would have been the pain management team, since the patient had migratory joint pain.

The cost/benefit ratio was extremely beneficial for this patient. The hospital covered all of his expenses so he was able to make significant gains for little to no cost. However, if the hospital had not been paying for the treatment, we could have potentially talked to occupational therapy and restorative therapy and seen what we could have done to decrease the amount of visits per week from each therapy. We could have also decreased the amount of time we spent with him each day and supplemented this with a more intense home exercise program. The pay for performance movement would indicate that we use more functional outcomes measures to show our progress, something that I will be more aware of and utilize in the future. This case has really influenced me to seek professional continuing education in regards to exercise programs involving the elderly. I have been attending the Parkinson's Pwr classes and the concept of large movements to increase posture, weight bearing, and mobility would have been very beneficial for this particular patient. I will seek out learning and continuing education opportunities such as this in the future.

Overall, this particular case really helped me expand my examination, evaluation and plan of care expertise. The multiple impairments and complexity of this case helped me to gain a greater understanding of the body and how multiple systems play a part in each individual's care.

APPENDIX 1

Nymph:

1). "a young insect that has almost the same form as the adult"[4]

2). "any of various immature insects; *especially*: a larva of an insect (as a grasshopper, true bug, or mayfly) with incomplete metamorphosis that differs from the imago especially in size and in its incompletely developed wings and genitalia"[4]

APPENDIX 2

Table 4. Pelvic Floor Exam Results

Observation	Hemorrhoid: left, external anal sphincter Skin tags around internal anal sphincter
Gross light touch sensation perianally	WNL, equal bilaterally
Anal wink	Present bilaterally
External anal sphincter	Positive for timing contraction during cough, 4/5 strength
Internal anal sphincter	Positive for timing contraction during cough, 4/5 strength
Levator Ani contraction	4/5 on right, 4+/5 on left
Puborectalis contraction	Trace (1/5) bilaterally
Levator Ani Endurance	Right: 6/10 seconds, 3/10 repetitions Left: 7/10 seconds, 4/10 repetitions
Levator Ani quick contraction/relaxation	Right: 2/10 repetitions, inability to relax between Left: 10/10 repetitions, full relaxation between
Co-contraction of TA and pelvic floor	present
Obturator Internus strength	Right: 4/5 Left: 5/5

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