

CASE REPORT

An Interdisciplinary Approach to Treatment of a Patient with Chronic Pelvic Pain following Gall Bladder Surgery: A Case Report

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ABSTRACT

Background: Female chronic pelvic pain is often characterized by musculoskeletal dysfunction, psychological factors, and central sensitization of pain. This case report will describe the rehabilitation and outcome of a female patient with chronic pelvic pain following a surgical procedure for removal of the patient's gall bladder and a failed prior course of pelvic physical therapy. **Study Design:** Case Report. **Case Description:** A 42-year-old female underwent surgery to removal her gall bladder. After the surgery, she complained of severe pelvic and back pain. She underwent a previous episode of pelvic physical therapy with no improvement. For this case report, a physical therapist (PT) and a physiatrist collaborated on the patient's care. The patient's chief complaints were of pelvic pain, constipation, urinary urgency, sexual hypersensitivity, and dyspareunia. The PT used classification systems to diagnose predominating mechanism of pain and type of pelvic floor dysfunction. By classifying pain and dysfunction, the therapist was able to prioritize intervention strategies. **Outcome:** The patient reported a 90% overall improvement, significant improvement on 2 outcome scales, and achieved all of her patient specific functional goals. **Discussion:** An interdisciplinary approach to care and an active functional approach to rehabilitation treatment resulted in a successful outcome for this patient. An important focus of physical therapy treatment was the restoration of alignment and functional stability of the pubic symphysis joint and pelvic ring. Pain education and medication management were key components of treatment for chronic pain. The use of classification systems to identify and treat pain and pelvic floor dysfunction were especially useful for clinical decision making.

INTRODUCTION/BACKGROUND

The purpose of this case report is to describe the interdisciplinary treatment of a patient with chronic pelvic pain following surgery to remove her gall bladder. The patient had previously undergone a failed episode of pelvic physical therapy.

Chronic pelvic pain is defined as pain in the lower abdomen, pelvis, and/or groin lasting for greater than 3 months¹ and can be a difficult condition to treat. It has been reported that 3% to 9% of women without preoperative pelvic pain will develop pelvic pain or back pain in the 2 years after hysterectomy.² Often, musculoskeletal causes of pelvic pain are not considered as a cause of pain following abdomino-pelvic surgery. According to a recent review article,³ there are no gold standards for diagnosis of musculoskeletal causes of pelvic pain.

Multidisciplinary approaches to the treatment of pain, in which the patient consults with a number of different specialists who each conduct their own plan of care, are common in the US.⁴ An interdisciplinary collaborative approach to care can be distinguished from a multi-disciplinary approach in that the team of practitioners collaborate to mutually decide on the course of the patient's care.⁴ Patient care decisions by each discipline are directly influenced by the input and collaboration of the other discipline(s). This interdisciplinary approach to care was employed in this case report.

The patient's chief complaints were of anterior lower quadrant and abdominal pain (right worse than left) that was worse with sitting as well as constipation, urinary urgency, sexual hypersensitivity, and dyspareunia. Constipation is symptom defined by the ROME-II crite-

ria⁵ as a patient having at least 2 of the following complaints in any 12 weeks of the last 12 months: (1) straining more than 25% of bowel movements (BMs), (2) fewer than 3 BMs/ week, and/or (3) the sensation of incomplete evacuation/anorectal blockage during more than 25% of BMs. Urinary urgency is defined as the complaint of a sudden compelling desire to pass urine, which is difficult to defer.⁶ In this patient's case, sexual hypersensitivity was defined by the patient as increased sensitivity to sexual stimulation causing difficulty achieving orgasm because it caused intense pain. Dyspareunia is defined as pain during intercourse.⁷

CASE DESCRIPTION

The patient was a 42-year-old health care worker. After the laproscopic cholecystectomy (gall bladder surgery), she experienced urinary retention resulting in her inability to empty her bladder. Urinary retention was accompanied by significant pelvic and back pain. After 72 hours, she went home from the hospital with a straight catheter. Three days later, she began urinating spontaneously, without the need for catheterization. The patient was diagnosed as having myofascial pelvic pain by a team of physicians. She was prescribed Darvocet for pain. She underwent a course of 5 trigger point injections to the abdominal and external pelvic area. None of the injections were done intravaginally or intrarectally.

The patient underwent a concurrent course of physical therapy, which she described as consisting of massage to the abdominal and pelvic floor muscles, a TENS unit that was used externally on the lumbosacral spine, and a sacroiliac belt. The patient reported that she did not wear the SI belt after a few days. She reported that the physical therapy treatments were performed in the supine or prone position. The patient described the pelvic floor treatment as being focused on internal vaginal manual techniques, as well as abdominal massage, and instruction in a "pelvic floor drop" technique. She was told that the purpose of the drop techniques was to help relax the pelvic floor. She had been instructed to begin "kegel" exercises, or squeezing exercises. The patient reported that performing these exercises made her pain symptoms worse. She began performing some leg stretching exercises on her own. She reported that she had not been educated regarding posture or body mechanics, and had not done any treatment, activity, or exercises in an upright position. The combination of Darvocet, trigger point injections, and physical therapy treatment did not result in improvement in her symptoms. In fact, the patient reported that she was feeling worse as a result of the treatment.

A few months later, she traveled twice on long distance trips; once in a car and once in an airplane. After the trips, she reported that she developed the incapacity to sit because of pain. She then began to experience difficulty having bowel movements. The patient's internist referred her to an outpatient Physical Medicine and Rehabilitation (PM&R) physiatrist. The physiatrist then referred the patient to a physical therapist (PT). Both the physiatrist's and the physical therapist's clinical practices specialize in women's health rehabilitation. The physiatrist and physical therapist collaborated to provide an interdisciplinary approach to treatment of chronic pelvic pain.

PATIENT HISTORY

The patient was married with 2 teenage children living at home. Her past medical history was significant for treatment of anxiety with medication; (Ativan), gastroenterologic reflux disease or GERD, scoliosis, one C-section in 1994, one vaginal delivery, and surgery on her right hand in 2003 to remove a piece of glass. She also had a history of post-herpetic neuralgia. Her family history was significant for the occurrence of heart disease and stroke.

Prior to the surgery the patient was working full time as a health care worker in a hospital. Her husband worked full time. Prior to the surgery, she was performing most housecleaning duties as well as shopping and cooking for her household. She exercised by walking 3 miles, at least 3 days per week and attended exercise classes regularly prior to the surgery. She reported that she and her husband would have sex at least 3 times per week.

After the surgery, she had been unable to work full time because of the presence of pain. She was working part time. She reported that she could not turn a patient in bed independently to examine and care for a patient. She had been unable to exercise because walking fast caused increased pain. She had intercourse about once per week but it was painful and not enjoyable. She complained of sexual hypersensitivity; including increased pain in the form of bladder spasms following orgasm. She had been avoiding orgasm and direct sexual stimulation, but had continued to have intercourse. Activities of daily living were also affected as she had difficulty operating a vacuum. She often had severe difficulty and pain when attempting to have a bowel movement. She had difficulty sitting for more than 30 minutes.

The patient was taking a number of medications that her physician had prescribed. These included Lyrica for postherpetic neuralgia, and Miralax daily to improve the ease of bowel movements. She was also taking Zegerid and Nexium for the GERD. The physiatrist prescribed Celebrex, which she had just begun taking. She previously tried taking Darvocet for pain and did not find it helpful, so discontinued taking it.

MEDICAL DIAGNOSTICS

This patient had multiple diagnostic studies to evaluate for causes of pain. Pelvic ultrasound showed a left ovarian cyst. Magnetic resonance imaging (MRI) of her thoracic spine showed vertebral endplate irregularities in the mid and lower thoracic spine. An MRI of her lumbar spine showed small T12 hemangioma and vertebral end plate irregularities suggestive of degenerative disease. An MRI of the cervical spine on the same date showed moderate right C5-6 foraminal stenosis. She underwent colonoscopy with biopsy to evaluate her constipation complaints. The test was negative and all findings were normal. This patient reported that she has never smoked, and rarely drank alcohol. She reported that she was having regular menstrual periods.

The physiatrist performed a physical examination and reviewed all of the patient's medical records and imaging studies and diagnosed the patient with pelvic floor myofascial pain and dysfunction (right worse than left), sacroiliac joint dysfunction (right worse than left), pelvic floor dysfunction, pelvic obliquity, and thoracic and lumbar myofascial pain. The physiatrist referred the patient to the PT. Six days later, the patient was evaluated by the PT.

Review of Systems

A review of systems was performed as described in the *Guide to Physical Therapist Practice*.⁸ The patient was alert and oriented, pleasant, and talkative. She reported a pain level of 6-7/10 on a scale of 0-10, where 0 = no pain and 10 = pain that would compel the patient to go to the emergency room. Cardiopulmonary system review revealed normal nonlabored and nondyspneic breathing. Blood pressure was 132/75 and heart rate was 75 bpm. Respirations were 16 per minute, and she weighed 118 pounds. Her integumentary system examination was normal, with no rashes, wounds, or lesions. The neuromuscular examination revealed normal 2+ reflex testing for distal bilateral upper extremities biceps C7 and triceps C8, and distal bilateral lower extremities quadriceps L4, and gastrocnemius L5. Sensation testing for sharp dull and pinprick to bilateral lower extremities was normal and intact. Distal myotome testing was grossly normal, for L3 to S1. Musculoskeletal system review was grossly normal as well, as the patient was independent in ambulation, all transfers, and mobility. Upon questioning, the patient revealed that she had no limitations to learning, and no language barriers that might interfere with her ability to participate fully in an evaluation or in therapeutic intervention.

Tests and Measures

The physical therapist performed a detailed musculoskeletal examination using a number of tests and measures. Structural alignment of the lumbo-pelvic-hip complex was assessed by visual inspection and by palpation of pelvic bony landmarks of the anterior and posterior pelvis with the patient in the standing, sitting, supine, and prone positions. In all positions, the patient demonstrated a pelvic obliquity, or asymmetry of pelvic bony landmarks, with left anterior and right posterior innominate, right sacral side-bend and left rotation, which is also considered to be a right sacral torsion. Additionally it was decided that there was the presence of a right superior pubic shear, where the right pubic symphysis is elevated relative to the left. Previous research regarding the intertester reliability for the assessment of pelvic symmetry via palpation has revealed that the agreement between testers is poor, as evidenced by less than 50% agreement between testers.⁹ Levangie reported intraclass correlation coefficients (ICCs) of greater than .99 for palpation of ASIS and PSIS heights and ICCs of greater than .99 for the measurement of PSIS and ASIS positions.¹⁰ O'Haire and Gibbons reported inter-examiner reliability of symmetry of right versus left PSIS height to be .33.¹¹

Passive inter-vertebral motion testing of the thoracolumbar spine and pelvis was performed using both passive rotation testing and passive posterior to anterior joint motion testing with the patient positioned in the prone position. Passive joint mobility was significantly limited at the thoracolumbar junction. Segmental dysfunction at T12-L1 was identified. In 2008 Landel and his colleagues reported on the intertester reliability of 2 physical therapist's assessment of lumbar posterior-anterior motion and compared their determination of the least mobile segment to MRI results.¹² While intertester reliability of the least mobile segment was good (82% agreement, Kappa = 0.71), the agreement between the PTs and the MRI result was poor (Kappa = 0.04). Passive testing of the sacroiliac joints and pubic symphysis as described

by Hesch¹³ were performed and revealed hypomobility of the pubic symphysis joint and sacrum on the ilia. There is no specific reliability data available for this method.

Muscle length and flexibility testing was performed using a goniometer to measure muscle length as described by Kendall.¹⁴ An imbalance of the right hip rotator muscles was identified with the measurements of right hip external rotation 25°, and internal rotation of the hip was measured to be 60°. Left hip external rotation was 40°, and left hip internal rotation was 45°, which is within normal limits as described by Kendall.¹⁴ The goniometric determination of passive range of knee flexion and extension range of motion was recorded by Watkins et al in 1987.¹⁵ They found ICCs of .90 for flexion and .86 for extension.

Repeated active motion testing in the sagittal plane of the thoraco-lumbar spine was performed by having the patient move through full forward flexion 10 times and through full backward bending 10 times while in the standing position. Repeated motion testing of flexion and extension of the spine did not result in any change in pain symptoms or active motion.

A test of functional hip muscle strength and functional core stability was performed by having the patient stand and balance on one leg, then perform repeated single leg mini squats. Functional hip weakness was identified, with positive Trendelenburg sign, or hip drop on the nonstance leg. Left hip drop and medial knee movement during squat were greater than right indicating functional hip abductor and rotator muscle weakness. There is not good reliability data for the use of the Trendelenburg test during repeated mini squats.

Abdominal muscle strength was measured using the protocols described by Sahrman¹⁶ and Kendall.¹⁴ Abdominal muscle strength was identified in the lower abdominals at 2/5 and the upper abdominals measured 3/5. Manual muscle testing of the hips and lower extremities was performed and hip abductor muscle weakness 3/5 was identified bilaterally. Florence et al investigated the intrarater reliability of strength grades reported by physical therapists in patients with Duchenne's Muscular Dystrophy and reported the values to be .80 to .99.¹⁸ Cuthbert and Goodheart completed a literature review on the reliability and validity of manual muscle testing and stated "With regard to analysis there is evidence for good reliability and validity in the use of manual muscle testing for patients with neuromuscular dysfunction."¹⁹

Palpation examination of the hips, trunk, and abdomen revealed pain to palpation, or myofascial pain in the abdomen, especially in the right lower quadrant; especially bilateral iliopsoas, bilateral quadratus lumborum, thoracolumbar sacral paraspinal muscles, bilateral greater trochanters, bilateral iliotibial bands. Tenderness to palpation of the greater trochanters may be indicative of trochanteric bursitis. Trochanteric bursitis has also been associated with pelvic joint dysfunction and pelvic obliquity.¹⁷

According to the physiatrist's initial report, sacroiliac joint (SIJ) provocation tests were found to be positive during the examination by the physiatrist 6 days prior. These tests included the AP glide or posterior pelvic pain provocation tests (PPPT), as well as the forced FABER test. During the PPPT, the patient's hip is flexed to 90° while in supine. Pain is provoked in ipsilateral SIJ when examiner applies force through the femur. The

Forced FABER test is performed by placing the patient's leg in a flexed, abducted, and externally rotated position while in supine. Pain is provoked in SIJ when examiner applies overpressure to knee and opposite anterior pelvis. The PT performed these tests during exam but were not to be found positive during the PT examination. In 2007, Robinson and colleagues investigated the reliability of selected motion and pain provocation tests for the sacroiliac joint.²⁰ They reported that for the pain provocation tests the reliability values were moderate to good ($\kappa = 0.43$ to 0.84) and for the palpation test (joint play between ilium and sacrum) the reliability was poor.

The PT next performed both a vaginal and rectal pelvic floor muscle examination due to the patient's complaints of bowel and bladder problems, as well as sexual dysfunction, pain with sitting, and because the physiatrist had specifically requested a pelvic floor examination of this patient. Verbal informed consent was obtained from the patient for vaginal and rectal pelvic floor examination. Examination was performed as described in the Pelvic Physical Therapy Level 1 and Level 2 course manuals from the Section on Women's Health of the American Physical Therapy Association.^{21,22} The examination procedures emphasize the use of classification systems to identify specific pelvic floor muscle impairments.

On external visual examination of pelvic floor function,⁷ voluntary contraction and relaxation were present. However involuntary contraction and involuntary relaxation of the pelvic floor muscles were absent. Involuntary contraction is tested by observing the perineum while the patient coughs. The pelvic floor muscles should reflexively and involuntarily contract. The absence of reflexive contraction of the pelvic floor muscles during increased intra-abdominal stress may be indicative of a lack of reflexive contraction during other functional activities during which intra-abdominal pressures are increased. Involuntary relaxation is tested by observing the perineum while the patient is bearing down, as in defecation. The pelvic floor should involuntarily descend and relax. The absence of involuntary relaxation may be associated with constipation and defecation disorders, as well as a lack of coordination of the muscles during functional activity.

Anal wink reflex is tested by stroking the firm end of a cotton swab next to the anal sphincter. The reflex is intact when the external anal sphincter contracts in response to the stroking of the cotton swab. In this patient the anal wink reflex was absent. The significance of the absence of the anal wink reflex in an otherwise neurologically intact individual is generally downplayed as an insignificant finding. It is thought to be common among women who have undergone one or more vaginal deliveries secondary to over stretching of the pudendal nerves during vaginal delivery. In consideration of musculoskeletal function in patients with pelvic pain and defecation disorders, it is possible that the absence of any reflexive muscular activity may be a contributory factor in the patient's dysfunction.

Muscle testing of the pelvic floor muscles was performed by manual muscle testing using the Modified Oxford scale.^{23,24} The test was performed with the patient in the supine position. Both vaginal and rectal pelvic floor muscle test score was 2/5 bilaterally with 4 second max hold, repeated 5 times. Muscle testing of the pelvic floor muscles in the standing position was not performed.

Quality of pelvic floor muscle contraction and relaxation was also assessed as described by Shelley et al.²¹ The pelvic floor muscle contraction to peak was slow and weak. The ability of the pelvic floor muscles to relax after contraction was slow and incomplete.

Examination of the mobility of the coccyx and the sacrococcygeal joint was performed rectally. Normal motion of the sacrococcygeal joint is thought to be about 0° to 25° of flexion and 0° to 20° of extension.²⁵ Palpation and motion testing of this joint should not be painful. In this patient, the motion of the sacrococcygeal joint was hypomobile, less than 20° of flexion and extension, and also painful to palpation.

Palpation examination of the superficial and deep pelvic floor muscles was performed to identify any myofascial pain or trigger points. The transverse perineal muscles were tender to palpation, right worse than left. Palpation of the right obturator internus muscle was painful, and trigger points referring pain into the rectum were identified.

Pain Classification

A pain classification system was used to classify the patient's pain²⁶ in order to prioritize treatment. The patient's pain was classified as primarily ischemic in nature because the presenting symptoms were that the pain worsened with prolonged positions, such as sitting, symptoms were eased by change of posture, and symptoms worsened after activity.²⁷ An inflammatory nature of the pain was considered because the pain responded to the use of NSAIDs, however, the ischemic characteristics of the pain were predominant.

This patient also demonstrated both affective and central sensitization components of pain. She had a known pre-existing anxiety disorder. Affective factors including known psychiatric and psychological disorders, and known emotional responses to trauma or disease, can greatly influence a patient's response to pain as well as her pain behaviors.²⁸ Patient's who have undergone surgery can experience an affective response to the trauma of surgery, especially when the outcome of the surgery is different than the expected outcome. In this case the patient did not expect to have urinary retention nor pain following gall bladder surgery.

Central sensitization of pain refers to the phenomenon by which pain states become "imprinted in unique central nervous system pathways like those which produce memory."²⁹ Chronic central sensitization pain symptoms are affected by emotions and thoughts. This patient's pain became worse when she was anxious. Finally, a peripheral neurogenic pain mechanism was considered because of the fact that this patient had a history of post-herpetic neuralgia. Neuralgia is a cause of peripheral neurogenic pain, but this patient's primary pain complaints did not fit the classification of peripheral neurogenic pain because it did not follow a peripheral cutaneous or segmental distribution.

In summary, this patient's primary pain classification was ischemic, with a secondary mechanism of central sensitization. By classifying the predominant pain mechanisms during a clinical encounter, physical therapists may be able to more effectively treat pain especially in patients with chronic pain.²⁶

Pelvic Floor Muscle Dysfunction Classification

The classification system described by the International Continence Society⁷ was used to classify the patient's pelvic floor dysfunction. Because of the patient's difficulty in both generating a pelvic floor contraction, as well as her difficulty in relaxing the pelvic floor muscles, combined with widespread tenderness to palpation, the classification of Overactive Pelvic Floor Muscles was given. This patient also demonstrated pelvic muscle floor muscle weakness.

Evaluation

The patient was found to have several impairments each of which was described in the findings of the examination. The impairments included impaired postural alignment, impaired pelvic floor muscle function, impaired body mechanics, and impaired ability to cope with symptoms of chronic pain, bowel, bladder, and sexual dysfunction. Functional limitations included limitations in her ability to work and to perform ADLs at home. This patient had disabilities in bowel and bladder function, and sexual function. Disabilities are limitations in activity and/or functioning that are attributable to medical conditions in physical, mental, emotional, and/or sensory domains and, significantly, are also due to societal responses to those limitations.³⁰ Patients with chronic pelvic pain can be considered to suffer from "silent" disabilities, or disabilities that are not obvious to the casual observer. Silent disabilities can have severe consequences and negatively impact quality of life.

Outcome Tools

The patient was asked to complete 2 quality of life questionnaires, the Pain Disability Scale and the Functional Pelvic Pain Scale, during the initial evaluation, as well as periodically during and at the end of the course of care. The patient's responses to the PDS and the FPPS questionnaires, as well as to the PSFS over the course of treatment are presented in Table 1.

The Pain Disability Scale (PDS) is a modified version of the Pain Disability Index (PDI).³¹ In the PDS, all 7 of the items from the PDI are included, and 3 questions are added to inquire about sexual functioning, sleep, and thinking/cognition. The PDS has 10 questions or domains, and each question can be rated as 0 = no disability to 10 = complete disability. The PDS was chosen for this patient instead of the PDI because of the inclusion of the question regarding sexual functioning. The validity of the PDS has not been reported, however, the PDI has adequate internal consistency (Chronbach's = .86). High correlations have been noted between the Oswestry Disability Questionnaire, which measures disability related to back pain, and the PDI ($r = 0.83$).³¹

The Functional Pelvic Pain Scale (FPPS)³² was chosen because of its inclusion of bowel, bladder, and sexual function. The reliability and validity of the FPPS has not been reported. There are 8 categories for which the patient rates 0 for "no pain or disability," up to 4 for "unable to function because of pain."

The Patient Specific Functional Scale (PSFS)^{33,34} was used in order to identify the specific functional issues most important to the patient. For each activity identified by the patient in the PSFS, the patient was asked to rate the difficulty of the

activity, where 0 = completely unable to perform the activity, and 10 = able to perform the activity at the level prior to the injury. The Patient-Specific Functional Scale is an efficient and valid measure for assessing disability and change in disability in persons with low back pain, neck pain, and knee dysfunction. Validity of the PSFS has not been reported in patients with pelvic pain. The PSFS demonstrates excellent reliability ($R = .92$) and validity ($r = .73-.83$) compared with the Neck Disability Index. In a comparison of the PSFS to the Roland Morris questionnaire for low back pain and the numeric pain scale, the most responsive outcome proved to be the PSFS (effect size = 1.6).³⁴

Plan of Care

A physical therapy plan of care was formulated to provide once weekly treatments for 10 weeks. The patient's prognosis was good but also guarded because the patient had already tried and failed a previous course of physical therapy, and because of the chronicity of the pelvic pain. The physiatrist and physical therapist both believed however, that this patient would likely benefit from an active functional approach to lumbo-pelvic rehabilitation, combined with an aggressive medication and education treatment program for chronic pain. This active functional approach is in contrast to the more passive injection and manual approach to treatment that the patient had previously undergone. The treatment team planned to meet on a weekly basis during regularly scheduled case rounds to discuss the patient's response to treatment and to collaborate on a multifaceted approach to care. The plan of care included patient education on chronic pain; medication management; manual physical therapy to the spine, trunk, pelvis, hips, abdomen, pelvic floor, and coccyx; behavioral re-training for bladder and bowel; pelvic floor electrical stimulation; pelvic floor biofeedback; postural re-retraining; body mechanics re-training; and pelvic-core stabilization exercises.

Table 1. Patient's responses over time to the Pain Disability Scale (PDS), The Functional Pelvic Pain Scale (FPPS), and the Patient Specific Functional Scale (PSFS)

Date	Initial	6 weeks	9 weeks	1 1 weeks
PDS (10 questions, 0 = no disability, 10 = total disability)	37	26	20	5
FPPS (8 questions, 0 = no disability or pain, 4 = unable to function because of pain)	20	13	10	5
PSFS (0 = unable, 10 = able to perform at level prior to injury, NT = not tested)				
turn patient while at work to observe wound	0/10	3/10	NT	10/10
vaccum	3/10	7/10	8/10	10/10
walk 3 blocks	3/10	6/10	NT	10/10
have a bowel movement	3/10	9/10	NT	9/10
sit for 30 minutes	3/10	6/10	NT	10/10

Physical Therapy Intervention

Patient education regarding chronic pain mechanisms, pacing of activities, decision making for self care, and the rationale for home exercises was emphasized throughout the course of care. The interventions were designed to combine a progression of patient knowledge and skills with a primary focus on restoration of function, as opposed to elimination of pain. The team agreed that the emphasis would be on functional skills over pain management, however that pain management would be an ongoing goal of patient knowledge and skill acquisition. The intention was that as she mastered each motor control skill and incorporated the knowledge she obtained through patient education, she would be able to build upon each skill to progress to more complex and more functional skills over time. The patient was encouraged to abide by the "rule of no worse," in which she could judge her tolerance to an activity as being good as long as she was not worse after completing the activity. Having pain during performance of an activity did not mean that she could not perform it. The patient was ultimately seen for a total of 11 physical therapy treatments.

During the first appointment after the initial examination, the therapist performed pelvic joint mobilization techniques to restore optimal alignment and mobility to the joints of the pelvic ring. These techniques included manual therapy techniques, such as direct posterior rotation of the patient's right ilium. The patient was also instructed in techniques to perform self mobilization to the pelvic joints. These included muscle energy techniques, such as performing a simultaneous isometric contraction of the right gluteus maximus and left iliopsoas to achieve a relative posterior rotation of the right ilium. One goal of self treatment technique was to restore optimal alignment and mobility of the pubic symphysis. Educators in manual therapy techniques for the pelvis differ as to their philosophy of the order in which techniques should be performed. Both Hesch¹³ and Paris³⁵ assert that the pubic symphysis joint acts like a "fulcrum" of mobility and stability for the pelvic ring. Further, Lee³⁶ hypothesizes that contraction of the pelvic floor muscles may result in approximation of the pubic symphysis joint. Other researchers have demonstrated that the pelvic floor muscles contribute to the stiffness of the pelvic ring.³⁷ Additionally the pubic symphysis is a key attachment point of the pelvic floor muscles, particularly the puborectalis muscle which is a key muscle during defecation.³⁸ The abdominal muscles and the bladder neck are attached to the pubic symphysis. Trauma to the pubic symphysis and pubic ramus has been correlated with abnormal urinary symptoms.³⁹ The goal of realignment and mobilization of the pelvis was to restore anatomical and length tension relationships of structures attaching to the pelvis, including the bladder and bladder neck, the rectum, and the pelvic floor, abdominal, and hip muscles.

The treatment team believed that it was important for the patient to become proficient in techniques to realign and mobilize her own pelvis. The pelvic joints seem more likely to become malaligned during daily activities while joint restrictions, muscle imbalances, and functional weakness persist. In some patients, a key component to restoring pelvic floor muscle function may be to maintain optimal alignment of the pelvic ring. The pelvic ring can be considered to be like the

"foundation of the house." If the foundation is unstable, the structures reliant on its stability will not function optimally. For this reason, the alignment and mobility of the pelvis was assessed and monitored at the beginning, during, and concluding each treatment session. Functional activities, sustained postures, and even sustained sleeping positions may cause malalignment, and thus mobilization and realignment of the pelvis were performed repeatedly throughout the course of care. The patient was instructed to perform self mobilization first thing in the morning after sleep; during the day, especially after strenuous activity, work, or sex, and before going to sleep to ensure that her pelvic joint was aligned and mobile.

The patient was advised to wear the sacroiliac belt (SI belt) during upright activities as long as the belt felt comfortable. She had been given a SI belt during the previous bout of physical therapy. Studies have shown that a SI belt may benefit the patient by reducing motion at the SI joint and/or by improving motor control of core muscles.⁴⁰

The focus of the second treatment following the evaluation was on both pain education and awareness of pelvic floor muscle activity. The concepts of central sensitization and chronic pain were discussed with the patient. Expectations for the course of therapy were discussed, including the focus on function versus pain, and including the expectation of flare ups of pain symptoms during the progression of treatment. The concept of pacing of activities and the "rule of no worse" were discussed. The patient was asked to purchase and read a book on chronic pain entitled, *Managing Pain Before It Manages You*.⁴¹ This book is designed to educate the patient about self management of chronic pain.

During the second treatment, the patient was issued a voiding diary and instructed in how to record fluid and food intake, and bowel and bladder activity for 4 days. She was issued a combination electrical stimulation and biofeedback device, the Empi Minnova (manufactured by Empi Inc), to be used at home to perform pelvic floor muscle sEMG biofeedback and electrical stimulation. The patient was asked to practice using the biofeedback unit in performing submaximal pelvic floor muscle contractions with a focus on a controlled and complete relaxation following the contraction. Retraining of the motor control of the pelvic floor is an initial intervention for patients with pelvic floor muscle dysfunction and an overactive pelvic floor. When patients are not able to relax the pelvic floor muscles reflexively, the overactive pelvic floor muscles may perpetuate ischemic muscular pain.²⁷ After the patient achieves the ability to control and maintain resting levels of the muscle, then treatment can focus on muscle contraction, especially during functional daily activities.

Pelvic floor muscle electrical stimulation was also initiated. The patient was asked to perform up to 15 minutes of pelvic floor muscle neuromuscular electrical stimulation using 2 frequencies of stimulation on alternating days via an intravaginal electrode. One day, she would use a 50 Hz frequency. This frequency of stimulation is often used in patients with weak pelvic floor muscles to facilitate awareness and proprioception of pelvic floor muscle contraction.²¹ On the alternate days, she would use a 12Hz frequency, which can effectively reduce urgency in patient's with urge incontinence and symptoms of urinary frequency.⁴² Low frequency stimulation has also been shown to reduce pelvic floor pain in patients with

chronic pelvic pain.⁴³ Initially, she was instructed to use the stimulation for 5 minutes, and gradually she progressed to using it for 15 minutes each time.

The third treatment focused on education and awareness of posture and activities while maintaining a neutral spine alignment. Multiple studies promote the idea that the deepest layer of core stabilizing muscles are optimally activated when the spine and pelvis are aligned in a neutral position.⁴⁵ The pelvic floor muscles, transversus abdominus muscles, the deep lumbar multifidi, and the diaphragm act as an inner cylinder or core, to stabilize the trunk and pelvis during functional activities.^{46,47} Neutral position is described as the position of optimal stability of the lumbar vertebrae in lordosis, but not in excessive lumbar extension. Nor is neutral spine thought to be achieved in a posterior pelvic tilt. Once the patient was taught to assume the neutral spine posture in the supine, sitting, and standing position, the PT applied tape in the shape of an "X" to the patient's posterior trunk across the thoraco lumbar spine. The tape was applied in 2 layers; first a layer of Cover-all tape (manufactured by Beiersdorf-Jobst) as an anchor. Secondly a layer of leukotape (manufactured by Beiersdorf-Jobst) was applied on top of the Cover-all tape. The purpose of the tape was to provide the patient with proprioceptive feedback during positions and body mechanics. If she moved into a flexed posture, she would feel the tape pull. The same was true if she were to rotate her trunk. She was asked to wear the tape for 2 to 3 days, including during sleeping and showering. She was given adhesive tape remover wipes and instructed in a safe method of removing the tape.

During the clinical session, the patient was verbally cued to activate her deep transverse abdominus muscles by "sinking in the abdomen" and to activate her pelvic floor muscles by performing a submaximal lift and squeeze as she had been practicing at home with biofeedback. She was then instructed in how to vacuum, do laundry, move around in the kitchen, make a bed, and perform a variety of ADLs while maintaining a neutral position of the spine and pelvis. She was asked to pay attention over the next 2 to 3 days as to when she would feel the tape pull, so that she would become aware of situation in which she was inclined to bend or twist. In the initial phases of rehabilitation for back and pelvic pain, it is a priority to teach the patient to be aware or and to control postures and body mechanics which might cause pain and pelvic mal-alignment.

Treatment number 4 consisted of instruction and practice of core stabilization exercises in the unloaded supine neutral position. The patient was also trained to perform core muscle activation during transitional movements, and purposeful core muscle activation during functional activities was reinforced through the treatment session. The PT reminded the patient that her pelvic floor muscles may not automatically or reflexively be contracting to provide functional stability during transitional movements and functional activities, as was demonstrated during the initial examination. Therefore, the patient should not assume that her muscles were automatically contracting, and she should purposefully contract them to ensure core muscle support.

During the fifth treatment, the patient brought her voiding diary. The PT and the patient reviewed the voiding diary,

and the patient was advised to increase her fluid intake of water to equal $\frac{1}{2}$ fluid oz per pound of body weight per FDA recommendations.²¹ This was equal to about 60 ounces of water-like fluid daily. The patient had been restricting fluid to about 40 oz per day because of her intermittent symptoms of urinary urgency and frequency. The PT told the patient that restricting fluid can worsen constipation.²² The PT provided education to the patient regarding normal bladder and bowel voiding patterns. The patient stated that she was relieved to know that it was considered normal to have a bowel movement every other day, and that she was not required to have a bowel movement every day. The idea of the necessity of have a BM everyday was causing her some anxiety. The PT instructed the patient in an optimal posture for defecation. When a person sits with hips flexed past 100° by leaning forward or by putting her feet on a stool, the puborectalis muscle surrounding the anal sphincter tends to relax involuntarily which can then ease the process of defecation.⁴⁸

During this session, the therapist also provided the patient with education regarding strategies for sexual functioning. The patient was asked to self stimulate, or masturbate, to desensitize herself to clitoral stimulation.⁴⁹ She was advised to practice pelvic floor muscle relaxation immediately following sexual activity and/or orgasm, in order to avoid or prevent ischemic muscular pain in the pelvic floor muscles. She was encouraged to use her home biofeedback unit if it would be helpful. If she did have increased pain following sex, the patient was advised to make sure that her pelvis was mobilized and realigned, and to consider trying electrical stimulation at 12 Hz to the pelvic floor muscles. Low frequency stimulation at 8 Hz has been shown to help reduce levator ani muscle pain and the patient's unit would only allow a lowest frequency of 12 Hz.⁴³

Manual therapy was initiated in the sixth treatment consisting of thoracic spine joint mobilizations to improve extension especially at the thoracolumbar junction, as well as a connective tissue mobilization and strain-counterstrain techniques⁵⁰ to the trunk, hips, vaginal and rectal pelvic floor muscles, and abdominal muscle trigger points. The patient's widespread myofascial pain may have resulted from chronic hypomobility and malalignment of the pubic symphysis and pelvic ring. Additionally, hypo-mobility of the coccyx was possibly contributory to pelvic floor over-activity, since the pelvic floor muscles attach to the coccyx via the anococcygeal ligament. Manual therapy to improve relaxation of the rectal pelvic floor muscles including the coccygeus²¹ was performed as well as gentle mobilizations of the sacrococcygeal joint as described by Maigne.⁵¹

The PT communicated the patient's progress at this point with a progress note to the psychiatrist, and the patient was scheduled for a follow up appointment to see the psychiatrist. The PT wrote in the progress note that the patient was ... "making excellent progress. Pelvis is level and stable. Pelvic floor muscle function has improved significantly. Pelvic floor strength has increased from 2/5 supine to 5/5 stand. Patient continues to have some difficulty with pelvic floor muscle relaxation after 5 reps of 5 second contractions. Pelvic floor myofascial pain is resolved. Patient is returned to normal sexual activity. Functional core strength is progressing. She continues to have T12 - L1 segmental dysfunction and some

scapular instability. Abdominal muscle strength is improving. She continues to present with intermittent trigger points in abdomen and hip flexors. She is using a home biofeedback and neuromuscular electrical stimulation unit with good success." The patient's answers to the quality of life questionnaires and the PSFS can be viewed in Table 1.

During the interval between her 6th PT appointment and her follow up with the physician, the patient had a flare up of symptoms of abdominal pain and constipation. She presented to the physiatrist reporting that she was overall 50% improved, however had been experiencing more right lower abdominal pain, and posterior pelvic joint pain. The physiatrist recommended a strategy for medication management, including a 3-day increase in Ativan to reduce the anxiety associated with the recent flare up of symptoms, and 3-day increase in Celebrex to reduce any inflammation associated with the flare up in symptoms. The physiatrist also prescribed an increase in Lyrica to reduce neuropathic contribution to pain symptoms. The physiatrist advised the patient to continue with physical therapy treatment for another 6 weeks and then to return for a follow up.

The treatment team continued to meet and discuss the case on a regular basis. The team felt that the patient's abdominal and bowel symptoms were mainly being caused by myofascial pain secondary to intermittent pelvic joint hypomobility and malalignment. The malalignment was being caused by the patient's increasing functional activity level. The combination of medical management and therapeutic strategies for pain management were working. The team agreed that future treatment should continue to focus on improving patient core stability while in functional weight bearing positions, and during work related activity.

The patient returned to physical therapy once per week for the next 6 weeks. Treatment consisted of a variety of interventions including continued manual therapy to mobilize the spine, realign the pelvis, and release muscle pain. Core stabilization exercises were rapidly progressed into standing functional exercises including multidirectional lunges, lunges with hip internal and external rotation, and functional squatting. The PT created a variety of work simulation activities designed to practice rolling patients in a hospital bed. The PT reinforced the patient's ability to maintain a relatively neutral spine position while simultaneously activating core muscles during work related activities.

The patient continued to demonstrate improved pubic joint alignment and stability, she would occasionally continue to present with pelvic joint hypomobility and sacral torsion. The patient and the PT agreed that her husband could be instructed in sacral and ilium pelvic joint mobilization techniques. He attended the 8th treatment session and was instructed in pelvic joint mobilization techniques including mobilization of the sacrum by applying a force to the left inferior lateral angle of the sacrum in a caudal direction, to theoretically push the sacrum out of a right side bent position. He was also shown how to mobilize the patient's left ilium into a posterior direction. The patient was advised to only ask her husband to perform the mobilizations when her own self mobilization techniques did not seem to be effective.

Pain education continued to be a focus of treatment through the course of care. The patient began to recognize that her

pain was worse when she was experiencing increased anxiety, and that she could sometimes help to control both her pain and anxiety with medication. She reported that she read parts of the pain book, and that understanding the impact of stress and emotions on her pain was important and helpful.

As the patient's stability and coordination during functional weight bearing activities continued to improve, the patient was instructed to begin a cardiovascular exercise program consisting of fast walking. She progressed her walking from 15 minutes initially, to 45 minutes at a time. Scapular strengthening exercises were incorporated. Now that the patient could functionally stabilize her pelvis during the stretch, stretching of the hip flexors was added. A dynamic multipositional core stabilization home exercise program using a Swiss ball and using a foam roll was prescribed. In the clinic, the patient was trained in the performance of a variety of Pilates exercises on both the reformer and trapeze table apparatus. The Pilates exercises included footwork and unloaded squatting on the reformer, neutral and articulated bridging, and "rolling up and down" with spinal articulation out of neutral on the trapeze table. Pilates exercises may be effective in increasing awareness of motor control when moving through varying ranges of spinal motion.⁵² This strategy allowed a progression of exercises which "articulate the spine" out of the neutral position, while continuing to activate the deep core muscles to provide stability and control of the spine and pelvis. The ultimate purpose of this last phase of exercises was to enable the patient to safely move through functional ranges of motion in flexion, extension, and rotation in the frontal, transverse, and sagittal planes.

Outcomes of Treatment

The patient completed the episode of physical therapy in 11 sessions. In the final progress summary the PT reported that the patient was ... "making excellent progress. Patient continues to need to self mobilize her pelvis. I have instructed her husband in some gentle mobilization techniques to provide to her sacrum and ilium to help her to restore optimal joint congruency in the pelvic joints. Pelvis is level and stable today. Pelvic floor muscle function has improved significantly. Pelvic floor strength has increased from 2/5 supine to 5/5 standing. Patient continues to use home biofeedback unit for muscle reeducation, and electrical stimulation for neuromotor facilitation and for pain management. Presence of pelvic floor myofascial pain is directly associated with pelvic joint status. When (patient) has a misaligned pelvis she has increased pain and bladder symptoms. She also has abdominal muscle myofascial pain and spasm in this circumstance. Patient is returned to normal sexual activity. Functional core strength is progressing very well; she is performing a cardiovascular walking program 45 minutes, 3 days per week. She is performing advanced core stabilization exercises using a Swiss ball and a foam roll. T-12 - L1 segmental dysfunction is improving as well as scapular stability. Abdominal muscle strength is improved. The patient's progress and improved functional outcome are demonstrated by her responses to the Pain Disability Scale score which decreased from 37/100 to 5/100, and the Functional Pelvic Pain Scale score decreased from 20/28 to 5/28" (Refer also to Table 1). She achieved all of her Patient Specific Functional Goals including: be able to

turn a patient independently while at work as a wound care nurse, vacuum, fast walk 3 blocks, have a bowel movement, and sit for 30 minutes. The patient was discharged from PT to her home exercise program.

The patient returned for a follow up appointment with the physiatrist. She reported that her overall pain level was 2/10 and that she was 90% improved. The physiatrist discharged the patient from follow up care as well.

DISCUSSION

An interdisciplinary and multimodal approach to care combining medication management, patient education, biofeedback, manual therapy, electrical stimulation, and an active functional approach to rehabilitation treatment resulted in a successful outcome for this patient. Women with chronic pelvic pain are often subjected to a variety of interventions including medications, surgery, and physical therapy. The collaboration throughout the course of treatment by the physiatrist and the PT may have resulted in a better outcome than an intervention by either independently. The treatment team developed consensus on the rationale and approach to treatment. The united front of the team approach may have instilled confidence in the patient.

The failure of prior interventions in the case of this patient may be attributed to a number of possible causes. The patient's medical diagnoses of thoracic endplate changes and cervical foraminal stenosis may have led other practitioners to conclude that the patient had degenerative spinal conditions that were causing or contributing to her pain. The prior course of physical therapy consisting primarily of passive myofascial treatment was not successful. Prior clinicians may not have identified a predominant central pain mechanism, and so education of the patient about pain mechanisms was not instigated. Critical aspects of pelvic rehabilitation may have been left out of the first course of therapy including the restoration of pelvic alignment and mobility, restoration of motor control of core stabilizers, and neuromuscular reeducation of pelvic floor muscle and core motor control during functional activity.

Prior to her initial evaluation by the physiatrist, the patient's chronic pain condition had not been directly addressed. The contribution of the affective and central components of the patient's chronic pain was likely significant. The PT's use of pain classification systems to identify and treat pain was especially useful for clinical decision making. Pain education should be the first intervention for patients with pain centralization.²⁶ The PT provided this patient with skills and knowledge to enable her independent management of a number of factors contributing to her pain. The use of medication management along with pain education was probably a critical factor contributing to the successful outcome. The physiatrist's recognition of the impact of the patient's anxiety reaction following a flare up, and her recommendation for aggressive medication management at that time, were likely important as well. The patient began to better understand the close relationship between anxiety and pain.

Little is known or understood about the importance of the pubic symphysis joint to bowel and bladder function. It is known that the pubic symphysis joint separates normally

during pregnancy⁵³ and that increased width of separation during pregnancy is associated with increased pain. It is not known whether some patients suffer from excessive separation or subluxation of the pubic symphysis joint during surgical procedures such as cholecystectomy.⁵⁴ Specific treatment of pubic symphysis dysfunction in this patient seems to have resulted in direct improvement of bladder and bowel symptoms. Through the course of therapy, the PT and the patient correlated the presence of pelvic floor myofascial pain with pelvic joint malalignment. For this patient, a hypomobility and misaligned pelvis was directly associated with an increase in pain and bladder symptoms. The patient was able to learn to manage this both by activating core muscles during functional activities to reduce the likelihood of causing pelvic malalignment and by regularly performing pelvic joint realignment techniques.

The use of quality of life questionnaires was helpful in identifying and measuring the amount of "silent disabilities" that the patient was suffering; particularly relating to bowel, bladder, and sexual function. The PDS and the FPPS along with the PSFS helped to focus the goals of therapy on the patient's specific functional needs, as opposed to pain or some other objective measures.

The rationale for therapeutic intervention for this patient can be summarized as follows:

- 1- address central sensitization component
 - a. medication management
 - b. chronic pain education, expectations, pacing, "rule of no worse"
 - c. focus on function, then pain
- 2- stabilize the pelvis by restoring length tension relationship of pelvic floor muscles between the pubic symphysis and coccyx
 - a. restore pelvic joint alignment and mobility
 - b. emphasize optimal core function in neutral spine posture
 - c. reduce pelvic floor muscle overactivity
- 3- restore core muscle motor control and function
 - a. support lumbo-pelvic-hip complex with core stability
 - b. facilitate pelvic floor muscle recovery: home BFB and NMES
 - c. stabilize pelvic ring during movement
 - d. facilitate core muscle motor control
 - e. SI belt as needed
- 4- specifically re-train functional skills
 - a. home ADLs
 - b. sexual strategies
 - c. bowel movement position
 - d. work activities

This patient was extremely compliant with all interventions. She agreed to take the medication as prescribed for her. She followed all instructions and recommendations for self treatment, home biofeedback, electrical stimulation, sexual homework, posture and body mechanics, and exercise. Her choice to fully participate in the plan of care was critical to her successful outcome.

This case has multiple implications for clinical practice. Rehabilitation can be successful for pelvic pain following

surgical procedures. The specific rehabilitation interventions and the philosophy of the PT providing care may make a difference in the patient's outcome. The philosophical priority of treatment was on patient's functional restoration. The focus on functional activities was seemingly quite different from the focus of the initial, failed course of PT. The use of classification systems to diagnose pain and pelvic floor dysfunction influenced the PT's clinical decision making.

Urinary retention is a common complication following abdominal and pelvic surgeries.⁴⁶ Perhaps trauma to or subluxation of the pubic symphysis joint should be considered as a mechanism of injury in patients who suffer urinary retention following abdomino-pelvic surgical procedures.

The impact of bowel and bladder and sexual dysfunction were significant disabilities of this patient. These issues must be identified and addressed for patients with pelvic pain to overcome their disabilities. Yet, these issues occur concurrently with and are related to other functional disabilities. Physical therapists who address only the pelvic floor related disabilities or only the functional disabilities in their patients with pelvic pain may not achieve successful outcomes. Physical therapists must address issues of silent disabilities in their patients with pelvic pain, as well as concurrent functional disabilities in order to successfully treat any of them.

This case illustrates the complex interaction between musculoskeletal factors, psychological factors, and central sensitization phenomenon in a patient with chronic pain. Female chronic pelvic pain may be most successfully treated when all factors are addressed concurrently. This case demonstrates how interdisciplinary collaboration and a function-based approach for the treatment of a complex case of chronic pelvic pain can result in a successful patient outcome. Medication management, pain education, and physical rehabilitation were all important factors in this patient's successful outcome.

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