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Management Of A Patient With Bronchiectasis Using Pulmonary Rehabilitation And Balance Training: A Case Report

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PTH 608: Case Report Template

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TITLE PAGE

Management of a Patient with Bronchiectasis Using Pulmonary Rehabilitation and Balance Training: A Case Report

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The patient signed informed consent allowing use of medical information for this report and was informed of the institution's policy regarding the Health Insurance Portability and Accountability Act.

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ABSTRACT

Background and Purpose: Bronchiectasis is a chronic lung disease defined by permanent, abnormal dilation of the bronchi and accompanied by chronic airway infection which leads to airway inflammation. Bronchiectasis is progressive and leads to a cycle of worsening pulmonary damage. Pulmonary rehabilitation, including progressive gait training, cycling, and stair climbing, is often utilized as treatment for this condition. However, there has been little research conducted on its effectiveness for bronchiectasis.

The purpose of this case report is to examine physical therapy (PT) management, utilizing pulmonary rehabilitation with incorporated balance training, for a geriatric patient with bronchiectasis.

Description: The patient was a 91-year-old female who was recommended to home health PT after hospitalization following exacerbation of bronchiectasis. The initial PT evaluation revealed a complex medical history with impairments in endurance, balance, and sensation. PT was provided in the assisted living facility, where the patient resided. Treatments included progressive gait and stair training, static and dynamic balance training, deep breathing and scapular retraction exercises, and chest percussion. Outcome measures performed included the Tinetti Performance Oriented Mobility Assessment (POMA), Timed Up and Go (TUG), Four Square Step Test (4SST), and the Functional Gait Assessment (FGA).

Outcomes: POMA score improved by 32% and FGA by 33%. TUG improved by 7.07 seconds. Time taken to complete the 4SST increased by 0.70 seconds with the patient progressing from contact guard assist to supervision to safely complete the test. Significant improvement towards goals was demonstrated by the ability to ascend and descend two flights of stairs and ambulate approximately half a mile on the sidewalk.

Discussion: Pulmonary rehabilitation in combination with balance training appeared to benefit a 91-year-old patient's physical function and contribute to her potential for participation in social activities in the community.

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BACKGROUND and PURPOSE

Bronchiectasis is a chronic lung disease that is defined by permanent, abnormal dilation of the bronchi. This disease is typically accompanied by chronic airway infection which leads to airway inflammation. It can be localized to a certain lobe of the lungs or generalized. It is most commonly generalized to the lower lobes which may be attributed to retention of secretions due to gravity. The process of bronchiectasis is progressive and typically leads to a cycle of worsening pulmonary damage. Because of the long term nature of this complex condition, the etiology and pathophysiology are not well understood. However, there are specific etiologic risk factors which include pulmonary infections, mucociliary disorders, immune disorders, inflammatory diseases, malnutrition, chronic obstructive pulmonary disease, aspiration, alpha 1-antitrypsin deficiency, and extreme ages including young children and the elderly.[1]

Patients with bronchiectasis typically present with symptoms of sputum production, cough, shortness of breath, and decreased endurance.[1,2] Causes of dyspnea and reduced activity tolerance include altered pulmonary mechanics, inefficient gas exchange, and reduced muscle mass.[1] Pulmonary rehabilitation, including progressive gait training, cycling, and stair climbing, is often utilized as treatment for this condition.[2] The aim of pulmonary rehabilitation is to decrease patients' symptoms and increase ability to participate in physical and social activities.[2]

Previous research established pulmonary rehabilitation as the gold standard of care for patients with Chronic Obstructive Pulmonary Disease (COPD).[3] However, a systematic review[3] was conducted in 2004 to define new pulmonary rehabilitation guidelines for the American College of Chest Physicians and the American Association of Cardiovascular and Pulmonary Rehabilitation. These guidelines established pulmonary rehabilitation as the standard of care for patients with COPD and for patients with any chronic lung disease causing a disability due to

respiratory symptoms. Although presently a standard guideline, little research has been conducted on the effectiveness of pulmonary rehabilitation in patients with bronchiectasis.[2]

In theory, pulmonary rehabilitation would be beneficial in improving the exercise capacity and decreasing the level of dyspnea in patients with bronchiectasis. Improvements in these areas would allow patients to become more independent in activities of daily living (ADLs) and instrumental activities of daily living (IADLs) as well as allow them to participate in social activities.[2] The purpose of this case report is to examine physical therapy management, utilizing pulmonary rehabilitation with balance training, for a geriatric patient with bronchiectasis in the presence of a complex medical background.

CASE DESCRIPTION

Patient History and Systems Review

The patient signed an informed consent form allowing use of medical records for this report. She was a 91-year-old female who was recommended to home health physical therapy after being discharged from a five-day hospitalization following exacerbation of bronchiectasis. Upon admission to the hospital, her sputum was tested and found positive for Escherichia coli bacteria which may lead to nausea, diarrhea, vomiting, urinary tract infections, respiratory illnesses, and pneumonia.[4] Her weight was 94 pounds, and her body mass index (BMI) was 16.3 which is considered to be very underweight. She was discharged to home with orders for use of 2 liters of supplemental oxygen through nasal cannula with titration as needed and a referral to home health physical therapy.

The patient's past medical history included chronic bronchiectasis, chronic bronchitis, chronic respiratory failure, peripheral neuropathy, tremor, vascular disease, vascular blockage of bilateral upper extremities, skin cancer, deep vein thrombosis, and right femoral fracture with

surgical repair. To ensure that her caloric intake was nutrient rich, she was on a restricted diet that excluded dairy, added sugar, and gluten. The patient reported cessation of smoking in 1940 and denied the use alcohol. The patient reported being physically active throughout her life and that prior to moving to the assisted living facility she would regularly swim and run for exercise. The patient also reported having a strong family support system that was always willing to help.

The patient resided on the third floor of an assisted living facility. Prior to her hospitalization, she would take the stairs instead of the elevator as much as possible and would normally eat lunch and dinner in the dining room located on the first floor. At the facility, house keeping services were also provided. However, she was independent with all other activities of daily living and all transfers.

The patient expressed goals of being able to return to walking inside her apartment and outside, along the river, near the assisted living facility. She expressed that she would like be able to function inside the apartment without use of supplemental oxygen. She expressed that she would like to be able to take the stairs in the building again instead of using the elevator. She also wanted to gain energy and decrease shortness of breath to be able to go shopping with her family.

A complete systems review revealed impairments in the patient's cardiovascular pulmonary and neuromuscular systems (Table 1).

Clinical Impression 1

The patient was diagnosed in the hospital with an exacerbation of bronchiectasis. Therefore, no differential diagnosis was necessary. However, the patient's comorbidities required consideration when evaluating and developing interventions. Her impaired endurance, balance, and sensation negatively impacted her ability to sleep through the night, perform

exercise, and participate in community activities. Based on the patient's activity limitations, participation restrictions, fitness background, strong family support, and good cognitive status, she was an excellent candidate for physical therapy.

Examination

A complete physical therapy examination was performed in the patient's apartment of the assisted living facility. She reported a nonproductive cough that prevented her from sleeping, fatigue with any physical activity, and decreased appetite without feelings of nausea, diarrhea, or constipation.

Transfers, bed mobility, and gait analysis were observed with the patient performing all tasks independently. The patient used an increased amount of upper extremity strength to transfer from sitting to standing from the living room recliner. When walking, she tended to look at the floor ahead of her.

The patient's active range of motion (AROM) and gross strength were found to be within functional limits. Although, AROM and gross strength have not been formally studied for reliability and validity, they are commonly used PT procedures that provides meaningful information.[5] The patient's awareness of light touch was assessed with a cotton ball and vibratory sensation with a tuning fork. Balance and fall risk were assessed using the Tinetti Performance Oriented Mobility Assessment (POMA) which has excellent test-retest and inter-rater reliability as well as excellent criterion validity with older adults[6] and the Timed Up and Go (TUG), which has excellent inter-rater reliability and construct validly with elderly adults.[7] The Four Square Step Test (FSST) was administered to assess balance.[8] The FSST tests higher level balance and mobility and has excellent-test retest reliability, inter-rater reliability, and criterion validity with the geriatric population.[8] This was used for this patient because of her prior level of

high activity and community participation.[8] The Functional Gait Assessment (FGA) assesses tasks often performed during gait of community dwelling adults and has excellent inter-rater reliability and construct validity with this population.[9,10] Since the patient wished to return to her prior level of function, including participating in community based activities, her fall risk and balance were also assessed with the FGA.[9,10] The 6 Minute Walk Test (6MWT) has excellent test-retest reliability and adequate criterion and construct validly in the elderly population and was used to assess the patient's cardiovascular and pulmonary fitness.[11] After completing the 6MWT with use of supplemental oxygen, the patient's fitness and recovery from activity were further assessed with the rate of perceived exertion (RPE) (Appendix 1), blood pressure (BP), pulse, and percentage of blood oxygen saturation (SpO2). A pulse oximeter was used to measure pulse and SpO2.[11,12]

See Table 2 for results of tests and measures performed.

Clinical Impression 2

The examination data confirmed the initial impression of deficits in transfers, endurance, and balance. The results of the 6MWT revealed decreased cardiovascular endurance, and deficits in balance were revealed by the results of the POMA and 4SST. Functional gait abnormalities were evidenced by the results of the FGA. Upon discharge, the patient was reassessed with these outcome measures as well as the TUG. It was established that the patient was limited in the distances that she could walk before becoming short of breath and had difficulty walking on uneven ground and climbing stairs. It was found that the patient also had deficits in light touch and vibratory sensation in the lower extremities. This along with her use of supplemental oxygen and her secondary diagnosis of peripheral neuropathy contribute to a lack of safety and places her at risk for falls. Based on ICD10 codes, the patient's medical diagnosis was J47.1,

bronchiectasis with acute exacerbation.[13] The patient was an appropriate candidate for the case report because of her complex medical history and recurrent, acute exacerbations of bronchiectasis.

It was anticipated that the patient would benefit from skilled physical therapy to improve her endurance and balance, to decrease her risk of falling, and improve her functional mobility. Her physical therapy plan of care included standing static and dynamic balance activities, transfer training, functional endurance training, and gait training. A long term goal of being able to independently ascend and descend two flights of stairs while using both hand rails and maintaining an O2 saturation of greater than 90% to improve endurance, within eight weeks, was established. Another long term goal was established to be able to use two hiking poles to independently ambulate on uneven terrain to the river, adjacent to the assisted living facility, to demonstrate improved endurance and balance within eight weeks. The short term goals for the patient included ascending and descending one flight of stairs independently while using both hand rails and maintaining an O2 saturation of greater than 90% in four weeks, improving functional balance and transfers by completing a sit to stand transfer from living room chair with minimal assistance of upper extremities in four weeks, and ambulating independently, with use of two hiking poles, on the sidewalk that circles the assisted living facility yard and building while maintaining an O2 saturation above 90% to improve endurance in four weeks.

The patient had strong family support, was very motivated to improve her functional ability, had experienced success with previous physical therapy, and demonstrated a strong understanding of her deficits. These factors were positive prognostic indicators and made the patient a good candidate for physical therapy. Due to the nature of the patient's multiple comorbidities, it was possible that progress toward goals could be slow, and the patient's functional abilities may not reach that of the pre-hospitalization baseline. According to a study

by Qi, Li, Li, and Li[14], the patient's low BMI is also a negative factor to her ability to fully recover from bronchiectasis without recurrent exacerbations.

Intervention

The patient was seen in her home by physical therapy twice a week for a four-week period, followed by once a week for the next four-week period. Each session lasted approximately one hour. Nursing services for the patient were provided as needed by the assisted living facility's nursing staff. Communication was made with the nursing staff following each physical therapy visit to inform them of the interventions provided and the patient's updated functional capabilities. Electronic medical records were updated after each visit documenting the patient's progress. No training was provided to the facility's staff or the patient's family.

Interventions for the patient were chosen to address her impairments in order to decrease her risk of falls and increase her participation in community based activities. Static and dynamic balance activities were introduced on a firm surface. Her static balance was challenged by standing with her feet together, standing with eyes closed, and standing on one foot bilaterally while maintaining a light, finger tip grip on the kitchen sink. The amount of time the static balance activities were performed was progressed over time with the patient's tolerance.[14] Dynamic balance activities were performed in the hallway of the assisted living facility where there were hand rails along the wall that could be used to maintain balance. The patient's dynamic balance was challenged with tandem walking, walking with her eyes closed, walking backward, and walking while turning her head.[15]

Aerobic endurance was addressed through gait training activities which began on flat surfaces for short indoor distances throughout the facility. The patient was progressed to longer distances and uneven, outdoor terrain with use of hiking poles as her tolerance allowed. Tolerance of gait training was measured by RPE (see appendix 1), pulse, and O2 saturation.[15]

By week three of treatment, the patient demonstrated improvements in endurance and balance, and stair training was initiated to further challenge her in these areas. The patient began stair training by ascending and descending half of a flight of stairs.[16] Since negotiating two flights of stairs to improve her daily activity level was one of the patient's goals, the amount of stairs negotiated was increased according to the patient's tolerance as assessed by RPE (see appendix 1), pulse, and O2 saturation.[16] Throughout the remaining weeks of treatment, the patient gradually decreased the amount of support that was required from her upper extremities and guarding.

During the seventh week of treatment, the patient presented in a distraught state that she expressed was due to issues with her family. She also demonstrated increased coughing, sputum production, and shortness of breath. Interventions on this day were altered to address the patient's current needs. The patient was guided through deep breathing exercises to help slow her breathing and take in oxygen more effectively.[17] Scapular retraction exercises were also introduced to improve the patient's posture and allow her to take in oxygen more efficiently. Chest percussions in side lying were performed to assist with moving mucus out of the lungs.[17] The patient was instructed to perform scapular retraction exercises twice a day for ten repetitions.

A home exercise program was given to the patient at her first follow up visit. The program included balancing in bilateral single leg stance at the kitchen sink with a finger tip grip three times a day for three repetitions.[15] To address the patient's difficulty with sit to stand transfers, half way sit to stands from the living room chair with minimal use of upper extremities three times per day for five repetitions were also added to the home exercise program. Once she progressed to safely negotiate half of a flight of stairs without supervision, she was instructed to

descend and ascend half of a flight of stairs once per day with use of upper extremities on bilateral hand rails.[16]

OUTCOME

Over the course of therapy, the patient reported increased ability to participate in community, family, and exercise activities with less fatigue. At the time of discharge, POMA score improved from 14/28, a high fall risk, to 23/28, a moderate fall risk, demonstrating positive changes in balance and gait.[6] POMA scoring at discharge placed the patient at a moderate fall risk, but her score of 23 was only one point lower than the cut off score of 24 which indicates low fall risk.[6] FGA scores improved from 12/30 to 22/30 demonstrating positive changes in ability to perform functional tasks during ambulation.[9] Although the patient's FGA score improved by ten points, it continued to place her in the fall risk category but was only one point away from the no fall risk category.[9] TUG time improved from 17.33 seconds, a high fall risk, to 10.26 seconds which is within the normative range for her age group, demonstrating improvements in mobility and gait speed.[7] Time taken to complete the 4SST increased from 13.30 seconds to 14.00 seconds with the patient progressing from contact guard assist to supervision to safely complete the test.[8] Due to time constraints, the 6MWT was not performed at discharge. However, progression was achieved in all other outcome measures.

The same therapist completed all tests and measures upon initial evaluation and at discharge. See Table 2 for detailed results of tests and measures performed at discharge.

DISCUSSION

Bronchiectasis is a chronic lung disease typically accompanied by disabling symptoms of coughing, dyspnea, and low levels of endurance, qualifying patients exhibiting symptoms for pulmonary rehabilitation.[1] The purpose of this case report was to document the pulmonary rehabilitation and balance training intervention program implemented to address the symptoms

of bronchiectasis in a geriatric patient. The patient in this report appeared to benefit from pulmonary rehabilitation with incorporated balance training by making significant improvements in endurance, symptom management, and balance. On admission to home health PT, deficits in endurance and static and dynamic, standing balance were evident. Interventions were designed and implemented to address these modifiable risk factors to decrease the patient's fall risk and improve her participation in functional and community activities.

After eight weeks of treatment, considerable improvements were noted in POMA, FGA, and TUG scores. At discharge, POMA and FGA scores were on the cusp of placing the patient into a lower fall risk category. This indicates significant improvement, and it is likely that approval of more physical therapy visits could have been highly effective.[6,9] Improvements were also noted in the 4SST by the decreased amount of assistance required to keep the patient safe.

At the time of discharge, significant gains were made toward the established physical therapy goals of ascending and descending two flights of stairs with use of handrails and ambulating on uneven terrain to the river with hiking poles. However, the patient's continued dependency on supplemental O2 when performing endurance activities restricted her ability to fully meet her goals. By the completion of physical therapy, she was able to independently take long walks on the side walk with use of supplemental O2 in a rolling cart. However, it was not possible for her to independently walk on the uneven terrain to the river while using hiking poles and rolling the O2 cart. The goal of stair climbing was set with the intention of getting the patient back to her prior level of function of taking the stairs, instead of the elevator, to access the first floor for activities including meals and business matters. At discharge, she was able achieve daily, short bouts of exercise by ascending and descending two flights of stairs with decreased use of her upper extremities while maintaining a 90% O2 saturation.[16] However, she continued to require use of the elevator when accessing to the lower level for activities. A limiting factor in fully

achieving this goal was her report of an increased RPE (see appendix 1) and need for supplemental O2 when completing activities following stair climbing. The assisted living facility was addressing this issue by ordering a portable oxygen concentrator back pack to aid in making her more independent.

New pulmonary rehabilitation guidelines from the American College of Chest Physicians and the American Association of Cardiovascular and Pulmonary Rehabilitation include pulmonary rehabilitation as the standard of care for patients with COPD and for patients with any chronic lung disease causing a disability due to respiratory symptoms.[3] By these standards, those with a diagnosis of bronchiectasis who are experiencing disabling symptoms would qualify for pulmonary rehabilitation. Although this treatment is a standard guideline, there continues to be little research conducted on the use of pulmonary rehabilitation for patients with bronchiectasis.[2] Further research is needed to determine the long term effects of these intervention techniques on improving the functional capacity of patients with bronchiectasis.

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TABLES

Table 1: Results of Systems Review

Systems Review	
Cardiovascular/Pulmonary	Impaired. Use of supplemental oxygen with nasal cannula. Patient reports shortness of breath due coughing that kept her awake at night.
Musculoskeletal	Not impaired
Neuromuscular	Impaired. Decreased static and dynamic standing balance. Patient decreased sensation in bilateral feet and ankles.
Integumentary	Not impaired
Communication	Not impaired
Affect, Cognition, Language, Learning Style	Not impaired. Patient preferred learning style is explanation.

Table 2: **Results of Physical Therapy Evaluation**

<table>
<tr><th>Tests & Measures</th><th>Initial Evaluation Results</th><th>Discharge Evaluation Results</th></tr>
<tr><td>Light Touch Sensation</td><td>Normal, unimpaired</td><td>Normal, unimpaired</td></tr>
<tr><td>Vibratory Sensation</td><td>Absent vibratory sensation in bilateral distal L3, L5, and S1 dermatomes. Absent in left L4 dermatome and diminished in right L4 dermatome.</td><td>Absent vibratory sensation in bilateral distal L3, L5, and S1 dermatomes. Absent in left L4 dermatome and diminished in right L4 dermatome.</td></tr>
<tr><td>POMA</td><td>14/28, high fall risk</td><td>23/28, moderate fall risk</td></tr>
<tr><td>TUG</td><td>17.33 seconds, high fall risk</td><td>10.26 seconds, not a fall risk</td></tr>
<tr><td>FSST</td><td>13.30 seconds with contact guard assist, not a fall risk</td><td>14.00 seconds with supervision, not a fall risk</td></tr>
<tr><td>FGA</td><td>12/30, fall risk</td><td>22/30, fall risk</td></tr>
<tr><td>6MWT</td><td>Test completed with use of supplemental oxygen. 827 feet completed. Immediately following test;
<table><tr><td>BP</td><td>120/59 mmHg</td></tr><tr><td>Pulse</td><td>102 beats per minute</td></tr><tr><td>RPE</td><td>4/10</td></tr><tr><td>SpO2</td><td>95%</td></tr></table></td><td>Not administered</td></tr>
</table>

POMA=Tinetti Performance Oriented Mobility, TUG=Timed Up and Go, FSST= Four Square Step Test, FGA=Functional Gait Assessment, 6MWT= 6 Minute Walk Test, BP= Blood Pressure, RPE= Rate of Perceived Exertion, SpO2= percentage of blood oxygen saturation

APPENDICES

Appendix 1: Rate of Perceived Exertion Scale

Rating	Descriptor
0	Rest
1	Very, very easy
2	Easy
3	Moderate
4	Somewhat hard
5	Hard
6	-
7	Very hard
8	-
9	-
10	Maximal