The Collaborative Role of Physical Therapy in Providing Comprehensive Care for the Pulmonary Patient

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COPD

- COPD is a systemic disease that has both pulmonary and non-pulmonary features (1).
- Non-pulmonary features that physical therapists can address during treatment include:
  - Skeletal muscle dysfunction
  - Osteoporosis
Skeletal Muscle Dysfunction in COPD

- Disuse and inactivity contribute to skeletal muscle dysfunction (1)
- Other systemic factors include systemic inflammation, malnutrition, corticosteroid use, hypoxemia, aging, and smoking (1)
Decreased Muscle Strength

- Research has shown that quadriceps femoris muscle strength is 20-30% lower in patients with moderate to severe COPD when compared to control subjects (1,2,3,4)
- Decreased muscle strength in patients with moderate COPD can contribute to poor exercise performance, increased shortness of breath, and worsening quality of life (1,2,5)
Decreased Muscle Strength

- Physical inactivity during hospitalization for acute exacerbations of COPD results in a decrease in quadriceps strength (6,7).
- Exercise during or shortly after acute exacerbations results in significant improvements in quadriceps strength (6,8,9).
Decreased Muscle Endurance

- Research has shown that limb muscle endurance is decreased by about 30% in patients with moderate COPD (1,10,11).
- Allaire and colleagues concluded that this decrease in muscle endurance is related to the mitochondria’s reduced oxidative capacity leading to the development of oxidative stress in the muscle (1,12).
Muscle Fiber Atrophy

- Research has shown that limb muscles in patients with COPD develop significant reductions in mass and cross-sectional areas (1,13,14)
- Research by Mador and colleagues suggests that limb muscles of patients with COPD fatigue more than healthy subjects (1,15)
Muscle Fiber Type Shift

- In patients with severe COPD, there is a reduction in the proportion of type I (slow-twitch) muscle fibers and a shift towards type II (fast-twitch) muscle fibers (1).
- Type II muscle fibers are more prone to fatigue so a shift towards type II muscle fibers may factor into increased leg muscle fatigue and decreased endurance (1).
Non-Pharmacological Treatment for Muscle Dysfunction in COPD

- Exercise training reverses some of the underlying skeletal muscle abnormalities found with COPD (6)
- Exercise training significantly improves quadriceps strength, endurance, and fatigability (6, 16, 17, 18)
Non-Pharmacological Treatment for Muscle Dysfunction in COPD

“Exercise training, in the form of pulmonary rehabilitation (PR), has emerged as the most effective non-pharmacological intervention in improving exercise capacity, dyspnea, and health status in COPD patients, as evidenced by numerous randomized controlled trials and meta-analyses. Given that PR does not directly improve lung mechanics or gas exchange, it is likely that the main area of improvement with exercise lies in the skeletal muscle.” (6)
The Role of PT in Providing Comprehensive Care for the Pulmonary Patient

- Role #1: Evaluating and treating patients with orthopedic conditions that are limiting the pulmonary patient’s participation in pulmonary rehab
  - Using modalities (ultrasound, electrical stimulation, iontophoresis, hot/cold packs, aquatic therapy) to reduce pain
  - Using manual therapy techniques to decrease muscle guarding and increase joint mobility
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- Providing patients with stretches to address decreased flexibility of various muscle groups
- Providing patients with strengthening exercises to address isolated areas of muscle weakness
- Educating patients on proper posture and body mechanics to reduce the risk of aggravating orthopedic conditions
Case Study #1

- 70 y.o. male with c/o LBP and right LE pain
- PMH consisting of idiopathic pulmonary fibrosis, abdominal aortic aneurysm, DM, HTN, and inguinal hernia repair
- Pain limiting patient’s ability to fully participate in pulmonary rehab exercise program
- Limited with walking on treadmill and elliptical
- Patient’s goals: 1) be able to fully participate in pulmonary rehab, 2) be able to complete 6 minute walk test when returning to Cleveland Clinic for 6 month re-check, 3) increase standing and walking tolerance for everyday activities
Case Study #1

- Patient’s symptoms consistent with lumbar spinal stenosis
- Manual lumbar traction to reduce right LE pain and electrical stimulation/moist heat to reduce LBP
- Flexion based stretching exercises and core stabilization/hip strengthening exercises
- Patient education on proper posture/body mechanics
Case Study #2

- 58 y.o. female with knee OA
- Knee pain limiting patient’s ability to fully participate in pulmonary rehab exercise program
- Physical therapy intervention consisting of aquatic therapy to decrease pain and improve patient’s tolerance with pulmonary rehab exercise sessions
- Gain patient independence with aquatic therapy exercises for patient to continue with at heated community pool after discharge from physical therapy
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- Role #2: Recommending appropriate modifications to the pulmonary patient’s exercises in pulmonary rehab to avoid aggravating orthopedic conditions
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- Role #3: Making recommendations for assistive devices and medical equipment when appropriate
- Examples:
  - Rollator walker
  - Wheelchair
Case Study #3

- 82 y.o. male with COPD with prescription for a scooter
- Evaluated by OSU’s Assistive Technology Department’s Wheelchair Seating Clinic
- Patient evaluated for power wheelchair with:
  - Joystick control to put patient in a more upright position
  - Tilt control and better seat cushion options
  - Portable oxygen unit holder
- Allowed for increased maneuverability in tighter spaces to promote increased independence with everyday activities
Osteoporosis

- Patients with COPD have an increased risk for osteoporosis and fractures (19)
Osteoporosis

- Decreased bone mineral density and increased risk of fracture is associated with current or past tobacco smoking, inactivity, and weight loss in patients with COPD (19,20)
- Patients with COPD often are deficient in calcium and vitamin D nutritional status (19)
Treatment with oral glucocorticosteroids is also a risk factor (19)

- Less negative effects of glucocorticosteroids are found with sporadic vs. continuous use and with continuous lower doses vs. frequent higher doses (19, 20)
- Oral glucocorticosteroids can cause rapid bone loss within the first few months of treatment and then a 2-5% bone loss per year with chronic use (19, 21)
- High doses of inhaled corticosteroids seem to increase bone loss, but it is difficult to determine the extent of the effect of the inhaled corticosteroids due to other risk factors, previous and/or current oral glucocorticosteroid use, and severity of the COPD (19, 20)
Osteoporosis

- The more severe the COPD, the increase the risk for osteoporosis and fracture (19, 20, 22, 23)
- Hip and vertebral fractures can impair overall mobility
- Vertebral fractures reduce lung function and decrease the forced vital capacity, resulting in increased operative risk in COPD patients with osteoporotic hip fractures (19, 20, 22, 24)
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- Role #4: Providing osteoporosis screenings for LVRS patients
- Completing a 20 question questionnaire of risk factors for osteoporosis
- Recommending the need for a DXA scan as appropriate
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- It is suggested that men with 3 minor criteria of: BMI < 21 kg/m², current smoker, alcohol use >3 drinks/day, age >65 years, history of hip fracture in parent, history of rib fracture, inactivity, FEV₁ <50% predicted OR 1 major criteria of: systemic corticosteroids (3 months/year), major fragility fracture (spine-hip) have a DXA scan due to increased risk for osteoporosis (25)
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- Role #5: Reducing fall risk in patients with COPD
Fall Risk in Patients with COPD

- Research suggests that older adults with COPD demonstrate balance deficits that may be associated with an increased risk in falls (26, 27)
- Balance training and fall prevention is not a requirement of Pulmonary Rehabilitation (26, 28)
Fall Risk in Patients with COPD

- A study by Beauchamp et al. assessed patients’ balance before and after a 6 week inpatient pulmonary rehab program.
- The program consisted of: supervised endurance exercise training 4-5 days/week, LE/UE strength training 3 days/week, breathing exercises daily, and self-management education (26).
Fall Risk in Patients with COPD

- Results of study:
  - Minor improvements in results of standard clinical tests of balance (26)
  - No significant improvement in balance confidence (26)
  - The incorporation of specific balance training exercises and fall prevention strategies during pulmonary rehabilitation needs to be reviewed (26)
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- Assessing patients for history of falls
- Assessing patients for balance deficits and fall risk
  - TUG: > 20 seconds indicates increased fall risk
  - 40’ Gait: < 10 seconds indicates safe community ambulation speed
  - Berg Balance Test: < 45/56 indicates increased fall risk
  - Tinetti Assessment Tool: <19 indicates high fall risk, 19-24 indicates greater fall risk
  - Dynamic Gait Index: < 17/24 indicates increased fall risk
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- Addressing any balance deficits with balance training
- Addressing any abnormal gait patterns to reduce the risk of falling
- Educating patients on fall prevention strategies
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- Role #6: Educating the pulmonary patients on osteoporosis
- Provide general overview of osteoporosis
  - Statistics of osteoporosis and osteoporosis-related fractures
  - Risk factors for osteoporosis
  - DXA scans to evaluate for osteoporosis
  - Modifiable risk factors that patients can address to promote improved bone health
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- Educating patients on home exercise program to:
  - Improve flexibility to promote improved posture
  - Improve strength of core muscles which stabilize the spine and provide the foundation for upper and lower extremity movements
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- Educating patients in proper body mechanics, lifting techniques, joint protection of the spine, and exercise modifications
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- Educating patients on modifiable risk factors they can control
  - Nutrition
  - Avoiding deconditioning by performing regular exercise
  - Posture training
  - Balance and coordination training
  - Fall prevention strategies
  - Maintaining a healthy lifestyle
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- Encouraging patients to be advocates for their health and to address any concerns with their primary care physicians.
References


References


