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# Inpatient Physical Therapy Management For A Patient With Chronic Pulmonary Complications Secondary To Multiple Lobectomies: A Case Report

Bayley Archinal  
*University of New England*

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1 **TITLE PAGE**

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3 **Inpatient Physical Therapy Management for a Patient with Chronic Pulmonary**

4 **Complications Secondary to Multiple Lobectomies: A Case Report**

5

6 Bayley Archinal, B.S.

7

8 Bayley Archinal, BS is a Doctor of Physical Therapy Student at the University of New England,

9 716 Stevens Ave. Portland, ME 04103

10 Address all correspondence to Bayley Archinal at barchinal@une.edu

11

12 The patient signed an informed consent allowing the use of her medical history for this case

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15

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19

20 Key Words: Multiple lobectomies, bronchiectasis, pulmonary limitations, physical therapy

21

22 **ABSTRACT**

23 **Background and Purpose:** Bronchiectasis is a disease defined by abnormal dilation of the  
24 bronchi from recurrent infections and/or chronic inflammation, which can lead to irreversible  
25 lung damage. Based upon severity and patient response to conservative treatment, a lobectomy  
26 may be required to resolve their symptoms. Though surgery may provide symptom relief and  
27 improve overall quality of life, patients are likely to have long-term pulmonary complications.  
28 There are several studies regarding the treatment of patients with pulmonary limitations  
29 secondary to a lobectomy. However, there is little to no evidence regarding the long-term  
30 treatment of patients who have undergone multiple lobectomies. The purpose of this case report  
31 was to describe an appropriate intervention program for an 82-year-old female who suffered  
32 from multiple pulmonary complications secondary to multiple lobectomies.

33 **Case Description:** The patient was an 82-year-old female who had multiple lobectomies at age  
34 18 secondary to bronchiectasis. She was admitted to a skilled nursing facility (SNF) with a  
35 diagnosis of a chronic obstructive pulmonary disease (COPD) exacerbation. Her primary  
36 symptoms included generalized weakness and increased dyspnea. The prescribed intervention  
37 program included cardiovascular endurance training, dynamic standing balance activities and  
38 bilateral lower extremity (BLE) strengthening.

39 **Outcomes:** The distance on the 6-Minute Walk Test (6MWT) increased by 36.0 meters (m)  
40 (140.8m to 176.8m), dynamic standing balance increased from fair+ to good, BLE strength  
41 increased from 3+/5 to 4/5 (fair to good) and ambulation distance improved from 150 ft using a  
42 two-wheeled walker (2WW) to 300 ft using a four-wheeled walker (4WW).

43 **Discussion:** Incorporating cardiovascular endurance training, dynamic standing balance  
44 exercises and BLE strength training appeared to have improved this 82-year-old woman's

45 independence with functional mobility at discharge.

46 Word count: 3,102

47

48 **INTRODUCTION/BACKGROUND and PURPOSE**

49         Bronchiectasis is a disease defined by abnormal dilation of the bronchi, which is a result  
50 of recurrent infections and/or chronic inflammation.<sup>1,2,3</sup> These recurrent infections can destroy  
51 the cilia inside the airways, causing mucus to accumulate in the lungs.<sup>1,2,3</sup> The excess in mucus  
52 can lead to greater inflammation which further destroys lung tissue.<sup>1,2,3</sup> The annual incidence of  
53 bronchiectasis in the United States is estimated at 29 per 100,000 people; for unknown reasons,  
54 the incidence has increased 8% by annually since 2001.<sup>4</sup> As of 2013, between 340,000 and  
55 522,000 people in the United States are currently being treated for bronchiectasis.<sup>4</sup>

56         Based upon severity and patient response to conservative treatment, surgical repair may be  
57 required to resolve their symptoms.<sup>3</sup> Studies have shown that surgical approaches are effective  
58 in symptom control and improving patients' overall quality of life.<sup>3,5,6</sup> Depending on the extent  
59 of the damage, either a lobectomy or pneumonectomy is performed.<sup>5</sup> A *lobectomy* is the  
60 surgical removal of one lobe of a lung and a *pneumonectomy* is the surgical removal of an entire  
61 lung.<sup>5</sup> Although these two surgical procedures reduce the symptoms of bronchiectasis, patients  
62 who undergo one of these surgeries are more likely to have long-term pulmonary limitations.<sup>3</sup>  
63 The mortality rate of a lobectomy ranges from 9-25%.<sup>3</sup> The mortality rate of a pneumonectomy  
64 of the right lung (10-12%) is greater than a pneumonectomy of a left lung (1-3.5%).<sup>7</sup>  
65 Lobectomies decrease lung function by reducing pulmonary functional reserve and exercise  
66 capacity by 15% and 16%, respectively.<sup>8</sup> Pneumonectomies have a greater impact on lung  
67 function in that they reduce pulmonary functional reserve and exercise capacity by 35% and

68 23%, respectively.<sup>7</sup>

69           The patient described in this case report had irreversible lung damage secondary to  
70 bronchiectasis, which required multiple lobectomies. As expected based on the literature, she  
71 had multiple pulmonary limitations. There are several studies that explored the use of lower  
72 extremity (LE) strengthening exercises to improve the functional strength of patients with  
73 bronchiectasis.<sup>2,9</sup> A study conducted by Jenkins et al<sup>10</sup> concluded that LE endurance training  
74 can decrease complaints of dyspnea. Additionally, studies have supported the use of balance  
75 activities to reduce fall risk in the geriatric population.<sup>9,11</sup> Therefore, the prescribed intervention  
76 program incorporated therapeutic exercises aimed to improve the patient's cardiovascular  
77 endurance, dynamic standing balance and LE strength.

78           There are several studies regarding the physical therapy (PT) treatment of patients with  
79 pulmonary limitations secondary to a lobectomy.<sup>3,5,8</sup> However, there is little to no literature  
80 regarding the long-term treatment of patients who underwent multiple lobectomies. Therefore,  
81 the purpose of this case report was to describe an appropriate PT intervention program for an  
82 82-year-old female who suffered from multiple pulmonary complications secondary to multiple  
83 lobectomies.

84

## 85 **Patient History and Systems Review**

86           The patient signed an informed consent form allowing all medical records to be used for this  
87 case study. The patient was an 82-year-old female who was referred to a skilled nursing facility  
88 (SNF) following a seven-day hospitalization due to an acute exacerbation of chronic obstructive  
89 pulmonary disease (COPD).

90 The patient's past medical history included COPD, restrictive lung disease secondary to  
91 thoracic spine kyphosis, bronchiectasis, emphysema, recurrent pneumonia, asthma, pulmonary  
92 arterial hypertension, cardiomegaly, hypothyroidism, nephrolithiasis, gastroesophageal reflux  
93 disease, osteoporosis, bilateral hearing loss, depression, anxiety and blindness secondary to  
94 Stargardt disease. The patient's vision was 20/400 and had a loss of central vision in both eyes,  
95 but retained peripheral vision. The patient wore hearing aids to address bilateral hearing loss.  
96 The patient also had a recent fall resulting in a left wrist fracture. Past surgical history included  
97 cholecystectomy, hysterectomy, bilateral knee replacement, breast cancer with total mastectomy  
98 of left breast, and lobectomy of bilateral lower lobes and right middle lobe due to bronchiectasis  
99 at 18-years of age. The patient had no history of smoking.

100 Prior to hospital admission, the patient lived in a one-story home alone with family  
101 nearby to assist if needed. She had one step to enter the home with no handrails. She was  
102 independent in all activities of daily living (ADLs) and used a straight cane when ascending and  
103 descending her front step and when ambulating short distances, she used a four-wheeled walker  
104 (4WW) with swivel front wheels (Medline Industries Inc, Northfield, IL) when ambulating  
105 longer distances within the community.

106 The patient completed a 36-week pulmonary rehabilitation program two weeks prior to  
107 hospitalization to address an exacerbation of COPD. The patient believed she could have  
108 continued to improve her cardiovascular endurance, but she was discharged from pulmonary  
109 rehabilitation before she felt ready. The patient complained of increased dyspnea and  
110 generalized weakness. The patient was on three L of oxygen continuously via nasal cannula.  
111 The patient demonstrated some control of her dyspnea through pursed lipped breathing (PLB), a

112 technique she learned at pulmonary rehabilitation. She was discouraged with her inability to  
113 ambulate longer distances without the occurrence of dyspnea, but was otherwise content with  
114 her pulmonary status and overall health. Following her pulmonary rehabilitation program, the  
115 patient received home PT and occupational therapy (OT) once a week. See Appendix 1 for the  
116 patient's medication list and Table 1 for systems review results.

117

### 118 **Examination – Tests and Measures**

119 A PT and OT evaluation was performed simultaneously in the patient's room at the  
120 SNF. The PT portion of the evaluation included taking the patient's oxygen saturation and  
121 resting blood pressure while supine, LE range of motion (ROM), LE manual muscle testing  
122 (MMT), sensation testing of bilateral lower extremity (BLE), assessment of bed mobility and  
123 functional transfers, and gait analysis.

124 While the patient was supine and resting, her oxygen saturation was measured by a pulse  
125 oximeter to be 93%. Her blood pressure, assessed using a sphygmomanometer on her left arm  
126 while the patient was supine and resting, was 108/62 mmHg. The patient's gross BLE strength  
127 was graded as a 3+/5 in a seated position as described by Kendall.<sup>13</sup> See Appendix 2: Manual  
128 Muscle Testing Grades for muscle grade description. This muscle grade indicated that the  
129 patient could move through full ROM against minimal resistance.<sup>14</sup> Her active ROM, which  
130 was grossly measured visually while the patient was seated, was within normal limits. The  
131 patient performed functional transfers, which included sit to and from stand and transferring  
132 from her wheelchair to her bed with a two-wheeled walker ([2WW] Medical Depot Inc., Port  
133 Washington, NY), and required contact guard assistance (CGA). She was able to ambulate

134 using a fixed-wheeled 2WW with CGA. The patient ambulated on an even surface 75 feet,  
135 stopped to perform PLB in an attempt to control her dyspnea, and then ambulated another 75  
136 feet. The patient was able to decrease only some of her dyspnea through PLB. The patient also  
137 completed a 6-Minute Walk Test (6MWT) using a 2WW and three liters of supplemental  
138 oxygen during her initial evaluation to determine her exercise tolerance.<sup>15</sup> The 6MWT is valid  
139 for measuring exercise capacity in patients with COPD.<sup>15</sup> The patient ambulated 140.9 m  
140 during the 6MWT, which indicated that her exercise capacity was below average (222-562 m)  
141 for females ages 80 to 89 years old.<sup>15</sup> See Table 2 for detailed results of the tests and measures  
142 performed.

143

#### 144 **Clinical Impression: Evaluation, Diagnosis, Prognosis**

145 The patient was an 82-year-old female referred to a SNF following a hospitalization for  
146 an acute exacerbation of COPD. Upon evaluation, the patient presented with BLE weakness,  
147 impaired dynamic standing balance, decreased independence with functional transfers, and  
148 impaired endurance as indicated by her limited ambulation distance. The patient's chief  
149 complaint was how quickly she experienced dyspnea after ambulating short distances. The  
150 patient's primary goals before discharge were to decrease dyspnea and to discontinue  
151 supplemental oxygen use. It was anticipated that the patient would benefit from PT that focused  
152 on therapeutic exercises, neurological re-education, gait training and therapeutic activities to  
153 improve her functional limitations.

154 The patient's MMT scores indicated a decrease in gross BLE strength. The results of  
155 her 6MWT indicated impaired cardiovascular endurance<sup>10</sup> and elicited shortness of breath. The  
156 patient initially presented with a dynamic standing balance that was rated fair plus, which

157 indicated that she could maintain standing balance unsupported with minimal resistance. When  
158 analyzing the patient's gait, the patient demonstrated forward flexion of the trunk, inadequate  
159 bilateral hip extension and decreased bilateral step length. The patient's primary medical  
160 diagnosis was J44.9, COPD unspecified and a secondary medical diagnosis of I51.7,  
161 cardiomegaly. PT diagnoses included R26.2, difficulty walking, not elsewhere classified, and  
162 R27.2, unspecified lack of coordination. The patient's history of falls, impaired vision and age  
163 place her at an increased risk for falls.<sup>16</sup> This patient was appropriate for this case report due to  
164 her complicated pulmonary medical history and impaired vision.

165         Every week, the patient completed the 6MWT and LE strength testing to objectively  
166 measure her progress. The patient's plan of care (POC) included endurance training, dynamic  
167 balance training, therapeutic exercises aimed to strength BLE, therapeutic activities to improve  
168 functional transfers and gait training five times a week for four weeks. See Table 3 for the  
169 patient's short-term and long-term goals. It was recommended that the patient begin outpatient  
170 pulmonary rehabilitation upon discharge to continue improving her endurance and  
171 cardiopulmonary function.

172

### 173 **Intervention and Plan of Care**

#### 174 **Coordination, Communication & Documentation**

175         Through electronic medical records, the documentation from the patient's previous  
176 hospitalization was sent to the SNF. The documentation was reviewed by the PT and OT prior  
177 to the patient's initial evaluation. While at this SNF, the patient received nursing care, PT and  
178 OT. There was consistent communication with nursing in order to coordinate therapy sessions  
179 around the patient's medication schedule. Toward the end of the patient's care, there was

180 frequent communication with the discharge planner to ensure that the patient would be  
181 receiving a 4WW prior to discharge.<sup>10</sup> Communication with OT was consistent throughout the  
182 patient's care to ensure that the PT and OT treatment sessions followed after each other to avoid  
183 bringing the patient down to therapy more than once a day, if possible. Documentation for this  
184 patient included an initial evaluation, a weekly progress note and a discharge summary.

185

### 186 **Patient-Related Instruction**

187 The patient was educated on her prognosis as well as her POC. The patient received visual  
188 demonstrations and verbal instructions on how to perform each exercise properly and frequent  
189 verbal cues to adjust her technique to ensure that she was performing the exercise correctly to  
190 maximize the benefits. These cues became less frequent as the patient became more familiar  
191 with the exercises.

192 On her last day of therapy, the patient was educated on two different positions to relieve  
193 dyspnea. The first position was a seated position in which the patient was instructed to lean  
194 forward at her hips and to rest her forearms on a table. The second position was a standing  
195 position in which the patient was instructed to bend at the hips and lean her forearms on a high  
196 table or a counter top. These positions relieve dyspnea by recruiting the pectoralis major  
197 muscles, which would assist in elevating the ribcage during respiration (see Figure 1).<sup>10</sup> The  
198 patient was also instructed on the appropriate sequence when ascending and descending the  
199 stairs using a straight cane without a handrail, as she did not have a handrail at home.

200

### 201 **Procedural Interventions**

202 The patient was seen five times a week with treatment sessions ranging from 90 minutes

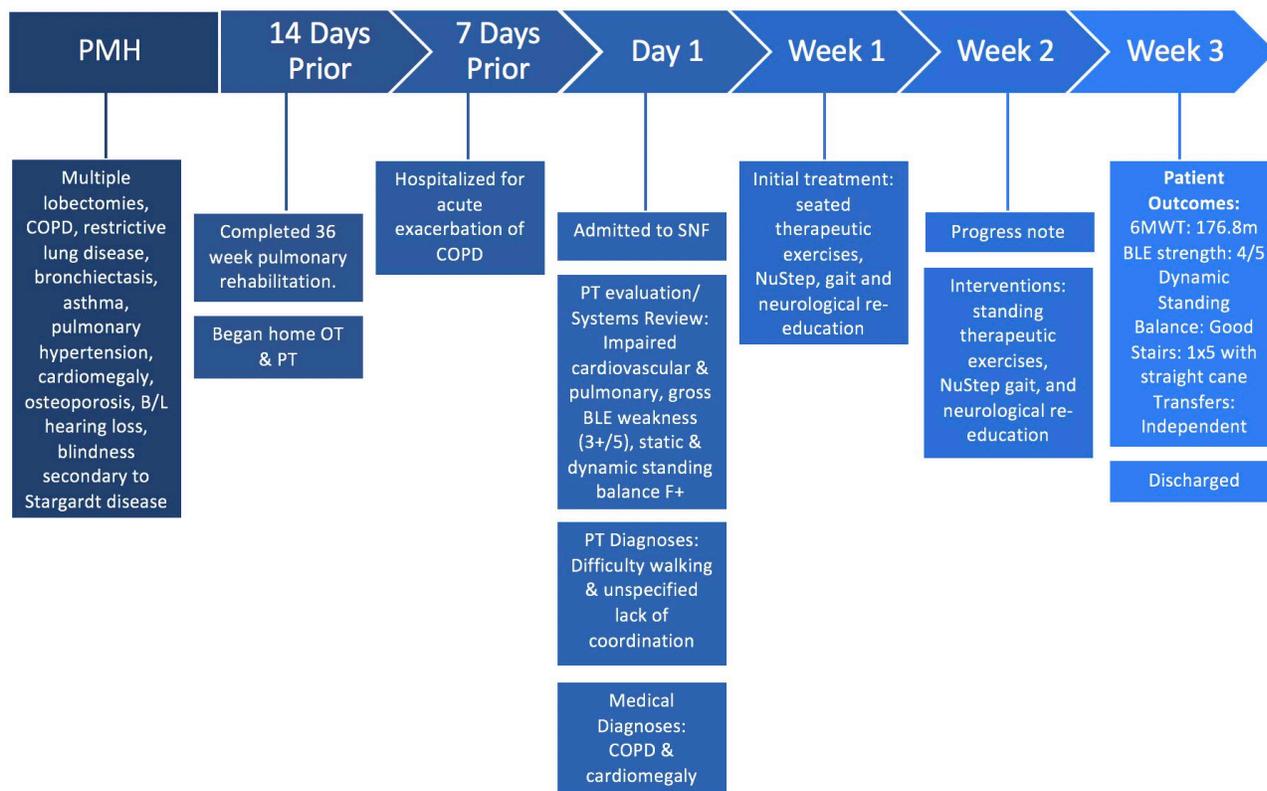
203 initially, to 30 minute as she progressed and approached her discharge date. The patient  
204 attended every treatment session and was eager to participate.

205         The interventions chosen addressed the patient's functional limitations and paralleled  
206 her goals. To prevent further decline in the patient's ability to perform ADLs, the treatment  
207 plan included therapeutic exercises aimed to strengthen the patient's BLE<sup>2</sup> and improve her  
208 cardiovascular endurance.<sup>17</sup> Strengthening exercises included hip flexion, hip extension, knee  
209 flexion, knee extension, calf raises, hip adduction, hip abduction, hip circumduction and a  
210 modified 30-second sit-to-stand exercise. Exercises were progressed once the patient was able  
211 to tolerate the repetitions without complaints of dyspnea and without requiring cues for  
212 technique. Endurance exercises included pedaling on the NuStep® (NuStep LLC, Ann Arbor,  
213 MI), ambulating with a 2WW and a 4WW with swivel front wheels (Medline Industries Inc,  
214 Northfield, IL). The NuStep® is a recumbent stepper and is one of the most preferred exercise  
215 machines among the geriatric population, specifically those with balance impairments.<sup>15</sup>

216         The patient initially ambulated with CGA using the 2WW because it provided greater  
217 stability than the 4WW. During week two, the patient changed her assistive device to the 4WW  
218 to adopt a faster gait speed and to decrease occurrence of dyspnea, as described by Jenkins.<sup>10</sup> In  
219 order to compensate for the patient's impaired vision, the patient was instructed to maneuver  
220 around different colored cones as she walked with a 4WW down a 75-foot carpeted hallway.  
221 The purpose of this exercise was to encourage her to scan her environment in hopes of reducing  
222 the risk of falls due to tripping over hazards and obstacles. The patient had recently fractured  
223 her left radius from a fall that occurred because she did not see a curb in front of her, causing  
224 her to misstep. This intervention was created specifically for this patient secondary to her past  
225 medical history and functional limitations. To improve the patient's dynamic standing balance,

226 the patient bounced a 12-inch ball with a therapist from different directions. The patient  
 227 initially stood with her normal base of support (BOS). She progressed to a narrow BOS and  
 228 then a semi-tandem BOS once she was able to maintain her balance for two minutes while  
 229 bouncing the ball. The Airex® (Baltek Inc., Greensboro, NC), a foam balance pad, was  
 230 introduced to the exercise once the patient was able to stand with a semi-tandem stance for  
 231 longer than two minutes while bouncing the ball. The patient stood on the Airex® with her  
 232 normal BOS and continued to bounce the ball with the therapist. The patient also shifted her  
 233 weight from her heels to toes when standing at the parallel bars using bilateral upper extremity  
 234 for support to improve her dynamic standing balance. Refer to Table 4 for intervention  
 235 progression.

236 **TIMELINE**  
 237



238

239

240 **OUTCOMES**

241 Over the course of her therapy, this patient was able to increase her exercise tolerance with  
242 less complaints of dyspnea. This patient was able to improve her 6MWT by 36.0 m (from  
243 140.8m to 176.8m) over the course of her treatment. The minimally clinical important  
244 difference (MCID) for the 6MWT is 54.0 m.<sup>10</sup> Although her change was less than the MCID  
245 and below the average for her age group, the patient was able to improve her distance while  
246 decreasing the need to stop due to shortness of breath. The patient was able to decrease her  
247 continuous oxygen use from three liters to two liters via nasal cannula. The patient increased her  
248 gross BLE strength from 3+/5 to 4/5 (see Appendix 2 for description of MMT values). Her  
249 dynamic standing balance improved from fair+ to good, which allowed her to perform  
250 functional transfers more easily. The patient was able to ascend and descend one step using a  
251 straight cane, which indicated that she would be able to ascend and descend the one step to enter  
252 her home once discharged. By the end of her treatment, the patient was able to independently  
253 complete all functional transfers with no verbal cueing (VC). Please see Table 5 for further  
254 detail on the patient's outcomes. Due to her enthusiastic attitude, the patient actively  
255 participated in and completed all treatment interventions. There were no adverse or  
256 unanticipated events during this patient's treatment.

257

258 **DISCUSSION**

259 As stated previously, this patient had many long-term pulmonary limitations secondary  
260 to multiple lobectomies. Patients who undergo a lung resection are likely to have long-term  
261 pulmonary complications. As supported by the literature, the patient benefited from completing

262 interventions that aimed to strengthen her BLE, improve her dynamic standing balance and  
263 improve her cardiovascular endurance.<sup>2,9,10,11</sup> Following three weeks of therapy, this patient  
264 was able to improve her 6MWT with less complaints of dyspnea. Although these results were  
265 not clinically significant, the patient demonstrated an improvement in exercise capacity.<sup>10</sup> The  
266 patient's BLE strength and dynamic standing balance improved, which allowed her to increase  
267 her independence with functional transfers.

268 Pulmonary function declines following a pulmonary resection.<sup>18</sup> Lobectomies have  
269 been shown to have a greater decrease in pulmonary function when compared to  
270 segmentectomies and partial resections. In a study by Kobayashi et al<sup>18</sup> (N=445) the  
271 percentages of vital capacity, predicted vital capacity percentage, forced expiratory volume in  
272 one second (FEV<sub>1</sub>), predicted FEV<sub>1</sub> percentage (FEV<sub>1</sub>%) and FEV<sub>1</sub>/forced vital capacity (FVC)  
273 five years after a lobectomy compared to preoperative values were 90.0 ±11.5%, 92.9±11.9%,  
274 86.2±11.9%, 91.1±12.7% and 95.9±11.5% respectively.<sup>18</sup> However, the rate of which  
275 pulmonary function declines following a lung resection is not dependent upon the type of  
276 surgery performed, but rather the age of the individual.<sup>18</sup> Overall pulmonary function decreases  
277 with age due to the physiological changes that occur within the respiratory system. These  
278 physiological changes include diminished elastic recoil of the lungs, increased chest wall  
279 stiffness, decreased strength of respiratory muscles, altered surfactant composition and  
280 increased ventilation-perfusion mismatching.<sup>18</sup>

281 One other factor that contributes to decreased pulmonary function following a  
282 pulmonary resection is the FEV<sub>1</sub>/FVC percentage.<sup>18,19</sup> Patients who have an FEV<sub>1</sub>/FVC < 70%  
283 have a greater rate of pulmonary function decline.<sup>18,19</sup> FEV<sub>1</sub>/FVC values < 70% are indicative  
284 of COPD.<sup>20</sup> Therefore, patients with COPD who undergo a lobectomy are likely to have a

285 greater rate of pulmonary function decline.

286 One of the strengths of this case report is that the patient attended all treatment sessions and  
287 was compliant with all interventions. She was highly motivated and had a great social support  
288 system. A limitation of this case report was the lack of ability to generalize the results to the  
289 general population. The patient's lobectomies were performed over six decades ago, and since  
290 then the gold standard for surgical intervention for bronchiectasis has changed from an open  
291 thoracotomy approach to a video-assisted thoracoscopic surgery (VATS).<sup>21</sup> It is difficult to  
292 compare her pulmonary function with patients who have had the VATS approach considering  
293 VATS is a less invasive surgery.

294 A potential implication for clinical practice is that patients who have undergone multiple  
295 lobectomies may benefit from PT that incorporates cardiovascular endurance training, dynamic  
296 standing balance exercises and BLE strength training in order to improve independence with  
297 functional mobility. It is suggested that future research investigate the long-term pulmonary  
298 effects of multiple lobectomies.

299 To summarize, clinicians should be aware of the type of pulmonary resection performed  
300 since contemporary surgeries are less invasive and may have less long-term pulmonary  
301 limitations. Clinicians should be aware that age of the individual, and/or the presence of COPD,  
302 have a greater effect on pulmonary function decline than the type of lung resection surgery.  
303 Regardless of the surgery performed, older individuals and/or individuals with COPD will have  
304 a greater rate of pulmonary function decline following a pulmonary resection.<sup>18,19,20</sup>

305

306

307

308 **REFERENCES**

- 309 1. Bronchiectasis. *Chest Foundation*. Web site. [https://foundation.chestnet.org/patient-](https://foundation.chestnet.org/patient-education-resources/bronchiectasis/)  
310 [education-resources/bronchiectasis/](https://foundation.chestnet.org/patient-education-resources/bronchiectasis/). Accessed July 17, 2018.
- 311 2. de Camargo AA, Boldorini JC, Holland AE, et al. Determinants of peripheral muscle  
312 strength and activity in daily life in people with bronchiectasis. *Phys Ther*.  
313 2018;98(3):153-161. doi: 10.1093/ptj/pzx123
- 314 3. Mauchley DC, Mitchell, JD. Surgery for bronchiectasis.2011:248-  
315 257.doi:10.1183/1025448x.10004710
- 316 4. Weycker D, Hansen GL, Seifer FD. Prevalence and incidence of noncystic fibrosis  
317 bronchiectasis among US adults in 2013. *Chronic Respiratory Disease*. 2017;14(4):377-  
318 384. <http://journals.sagepub.com/doi/full/10.1177/1479972317709649>. doi:  
319 10.1177/1479972317709649
- 320 5. Coutino D, Fernandes P, Guerra M, Miranda J, Vouga L. Surgical treatment of  
321 bronchiectasis: A review of 20 years of experience. *Portuguese Review of Pneumology*  
322 *(Revista Portuguesa de Pneumologia, English Edition)*. 2015;22(2):82-  
323 85. <https://www.clinicalkey.es/playcontent/1-s2.0-S2173511515001785>. doi:  
324 10.1016/j.rppnen.2015.09.007
- 325 6. Jin Y, Zhang Y, Duan L. Yang Y, Jiang G, Ding J. Surgical treatment of bronchiectasis:  
326 A retrospective observational study of 260 patients. *International Journal of Surgery*.  
327 2014;12(10):1050-1054. [https://www.clinicalkey.es/play-](https://www.clinicalkey.es/playcontent/1-s2.0-S1743919114008838)  
328 [content/1-s2.0-](https://www.clinicalkey.es/playcontent/1-s2.0-S1743919114008838)  
S1743919114008838. doi: 10.1016/j.ijssu.2014.08.398
- 329 7. Collins GL, Jacobsohn E. Complications after pneumonectomy. *Complications in*  
330 *anesthesia*. Second Edition ed.; 2007:376-

- 331 379. <https://www.clinicalkey.es/playcontent/3-s2.0-B9781416022152500971>.
- 332 10.1016/B978-1-4160-2215-2.50097-1
- 333 8. Win T, Groves AM, Ritchie AJ, Wells FC, Cafferty F, Laroche CM. The effect of lung  
334 resection on pulmonary function and exercise capacity in lung cancer  
335 patients. *Respiratory Care*.  
336 2007;52(6):720. <https://www.ncbi.nlm.nih.gov/pubmed/17521461>
- 337 9. Stubbs B, Brefka S, Denkinger MD. What works to prevent falls in community-dwelling  
338 older adults? Umbrella review of meta-analyses of randomized controlled trials. *Phys*  
339 *Ther*. 2015;95(8):1095-1110. <https://www.ncbi.nlm.nih.gov/pubmed/25655877>. doi:  
340 10.2522/ptj.20140461
- 341 10. Jenkins SC. 6-minute walk test in patients with COPD: Clinical applications in  
342 pulmonary rehabilitation. *Physiotherapy*. 2007;93(3):175-  
343 182. <https://www.clinicalkey.es/playcontent/1-s2.0-S0031940607000375>. doi:  
344 10.1016/j.physio.2007.02.001
- 345 11. Beauchamp MK, Janaudis-Ferreira T, Parreira V, Romano JM, Woon L, Goldstein RS,  
346 Brooks D. A randomized controlled trial of balance training during pulmonary  
347 rehabilitation for individuals with COPD. *Chest*. 2013;144(6):1803-1810. <https://www.clinicalkey.es/playcontent/1-s2.0-S0012369215486908>. doi: 10.1378/chest.13-1093
- 348 [clinicalkey.es/playcontent/1-s2.0-S0012369215486908](https://www.clinicalkey.es/playcontent/1-s2.0-S0012369215486908). doi: 10.1378/chest.13-1093
- 349 12. Damle SJ, Shetye JV, Mehta AA. Immediate effect of pursed-lip breathing while  
350 walking during six minute walk test on six minute walk distance in young  
351 individuals. *Indian Journal of Physiotherapy and Occupational Therapy*. 2016;10(1):56-  
352 61. [http://indianjournals.com/ijor.aspx?target=ijor:ijpot&volume=10&issue=1&article=](http://indianjournals.com/ijor.aspx?target=ijor:ijpot&volume=10&issue=1&article=013)  
353 013. doi: 10.5958/0973-5674.2016.00013.7

- 354 13. Pro Healthcare Products. Web site. Manual muscle testing grading chart Florence  
355 Kendall. [https://www.prohealthcareproducts.com/blog/manual-muscle-testing-grading-  
chart-florence-kendall/](https://www.prohealthcareproducts.com/blog/manual-muscle-testing-grading-<br/>356 chart-florence-kendall/). Accessed on August 2, 2018.
- 357 14. Kumar TSM, Kumar TM. An evaluation of exercise tolerance in COPD patients using  
358 six-minute walk test: A prospective study. *Indian Journal of Physiotherapy and  
359 Occupational Therapy*. 2011;5(3):74-78
- 360 15. Dalleck LC, Borresen EC, Parker AL, et al. Development of a metabolic equation for the  
361 NuStep recumbent stepper in older adults. *Perceptual and Motor Skills*.  
362 2011;112(1):183-192. [http://journals.sagepub.com/doi/full/10.2466/06.15.27.PMS.112.1.  
183-192](http://journals.sagepub.com/doi/full/10.2466/06.15.27.PMS.112.1.<br/>363 183-192). doi: 10.2466/06.15.27.PMS.112.1.183-192
- 364 16. American Geriatric Society, British Geriatrics Society, and American Academy of  
365 Orthopaedic Surgeons. Guideline for the prevention of falls in older persons. *J Am  
366 Geriatr Soc*. 2001;49:664-672
- 367 17. Cress ME, Meyer M. Maximal voluntary and functional performance levels needed for  
368 independence in adults aged 65 to 97 years. *Phys Ther*.  
369 2003;83(1):37. <https://www.ncbi.nlm.nih.gov/pubmed/12495411>.
- 370 18. Kobayashi N, Kobayashi K, Kikuchi S, et al. Long-term pulmonary function after  
371 surgery for lung cancer. *Interactive cardiovascular and thoracic surgery*.  
372 2017;24(5):727-732. <https://www.ncbi.nlm.nih.gov/pubmed/28204503>. doi:  
373 10.1093/icvts/ivw414
- 374 19. Berry MF, Yang CJ, Hartwig MG, Tong BC, Harpole, DH, D'Amico TA, Onaitis, MW.  
375 Impact of pulmonary function measurements on long-term survival after lobectomy for  
376 stage I Non-small cell lung cancer. *Annals of Thoracic Surgery*. 2015;100(1):271-

377 276. <https://www.clinicalkey.es/playcontent/1-s2.0-S000349751500291X>. doi:  
378 10.1016/j.athoracsur.2015.02.076

379 20. How is COPD diagnosed? COPD Foundation Web site.  
380 [https://www.copdfoundation.org/What-is-COPD/Understanding-COPD/How-is-COPD-  
381 Diagnosed.aspx](https://www.copdfoundation.org/What-is-COPD/Understanding-COPD/How-is-COPD-<br/>381 Diagnosed.aspx). Accessed October 7, 2018.

382 21. Okumura M, Shintani Y, Funaki S, Kanzaki R, Ose N, Minami M. VATS thymectomy-  
383 bilateral approach for extended resection. *Mediastinum*. 2010;2:387-396.  
384 Doi:10.21037/med.2018.04.03

385 22. Lexi-Drugs. Lexicomp. Wolters Kluwer Health, Inc. Riverwoods, IL. Available at:  
386 <https://online-lexi-com.une.idm.oclc.org/lco/action/home?siteid=1&>. Accessed July 29,  
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400 **TABLES and FIGURES**

401 **Table 1: Systems Review Results**

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<b>Systems Review</b>	
Cardiovascular/Pulmonary	Impaired Three liters of supplemental oxygen via nasal cannula. The patient complains of dyspnea early into any activity or exercise.
Musculoskeletal	Impaired MMT indicated general BLE weakness (3+/5). The patient also has thoracic spine kyphosis.
Neuromuscular	Impaired Static and dynamic standing balance rated fair +.
Integumentary	Not Impaired
Communication	Not Impaired
Affect, Cognition, Language, Learning Style	Not Impaired Preferred learning style is verbal explanation.

403 MMT=Manual muscle testing, BLE=bilateral lower extremities

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405 **Table 2: Test & Measures**

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<b>Tests &amp; Measures</b>	<b>Initial Evaluation Results</b>
6MWT (using a 2WW) – measures the patient’s endurance. (Average range for ♀ ages 80-89 = 222-562 m.)	140.8 m – using a 2WW
Blood Pressure	108/62 mmHg
O <sub>2</sub> Saturation	93% (on 3L of O <sup>2</sup> via nasal cannula)
Gross BLE Strength	3+/5
Gross BLE ROM	WNL for all LE joints.

407 6MWT=6-Minute Walk Test, 2WW=two-wheeled walker, BLE= bilateral lower extremities,  
 408 ROM=range of motion, WNL=within normal limits, LE=lower extremity, m=meters, L=liters,  
 409 O<sup>2</sup>=oxygen

410

411 **Table 3: Short Term and Long Term Goals**

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<b>Short Term Goals (2 weeks)</b>		
<b>IE</b>	<b>PN (2 weeks)</b>	<b>DC (3 weeks)</b>
The patient will increase BLE strength to 4- /5 to prepare for transfers.	Goal met New goal: The patient will increase BLE strength to 4/5 to prepare for transfers.	Goal met Status: 4/5
The patient will increase dynamic standing balance to good- spontaneously righting self when needed to reduce risk for falls.	Continue goal Status: fair+	Goal met Status: good
<b>Long Term Goals (4 weeks)</b>		
<b>IE</b>	<b>PN (2 weeks)</b>	<b>DC (3 weeks)</b>
The patient will safely perform functional transfers with independence and 0% VC to push up from arms of chair in order to return to prior level of functional abilities.	Continue goal Status: CGA and 10% VC	Goal met Status: Independent and 0% VC
The patient will safely ambulate on level surfaces 300 ft using a 2WW independently with 0% VC for proper sequencing in order to return to prior living and supervision levels.	Continue goal Status: 250 ft with CGA and 5% VC	Goal met Status: 300 ft independently with 0% VC
The patient will safely ascend/descend 1 stair independently without handrails and 0% VC for proper sequencing.	Continue goal Status: did not yet attempt	Discontinued Status: 1 step

413 IE = initial evaluation, BLE = bilateral lower extremity, PN = progress note, DC = discharge,  
 414 VC = verbal cues, CGA=contact guard assist, 2WW=two-wheeled walker, ft=feet

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416 **Table 4: Interventions**

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<b>Intervention Category</b>	<b>Purpose</b>	<b>Week 1 (5 visits)</b>	<b>Week 2 (5 visits)</b>	<b>Week 3 (3 visits)</b>
		<b>Seated</b>	<b>Standing</b>	<b>Standing</b>
<b>Therapeutic Exercise</b>	Increase BLE strength. Reduce fall risk. <sup>5,9</sup>	Knee extension: 2 lb, 3x10  Knee flexion: 2 lb, 3x10  Hip abduction: Green resistance band 2x15  Hip adduction: 1x30  Hip circumduction (with knee extended): 0lb, 3x10	Hip flexion: 2.5 lb, 3x10  Hip extension: 2.5 lb, 3x10  Knee flexion: 2.5 lb 3x10  Hip abduction: 2.5 lb, 3x10  Calf Raises: 2.5 lb, 2x15  modified 30-sec sit to stand x2 (use of BUE)	Hip extension: 2.5 lb, 2x15    Hip abduction: 2.5 lb, 2x15  Calf Raises: 2.5 lb, 1x30  modified 30-sec sit to stand x2 (use of BUE)
<b>NuStep®</b>	Improve cardiovascular endurance. <sup>15</sup>	Resistance level 1 20 mins 3 30-sec RB	Resistance level 2 25 mins No RB	Resistance level 2 25 mins No RB
<b>Gait</b>	Improve cardiovascular endurance and gait pattern.	2WW – 300ft 3 RB  6MWT – 2WW	4WW – 850 ft 5 RB Obstacles 2d/wk  6MWT – 2WW	4WW – 1,050 ft 5 RB Obstacles 1d/wk  6MWT – 2WW
<b>Step-ups (7 inch step; no handrail)</b>	Improve the patient's ability to ascend the step to enter her home.			Straight Cane - 2x5
<b>Neurological Re-Education</b>	Improve the patient's dynamic and static standing balance. <sup>11</sup> Reduce fall risk. <sup>9</sup>	Bounced ball – narrow BOS & semi-tandem BOS  weight shift from toes to heels x10	Bounced ball – (on airex) narrow BOS & semi-tandem BOS  weight shift from toes to heels x10	
<b>Education</b>	Positions for dyspnea relief. <sup>10</sup>			1 seated & 1 standing position for dyspnea relief (see Figure 1)

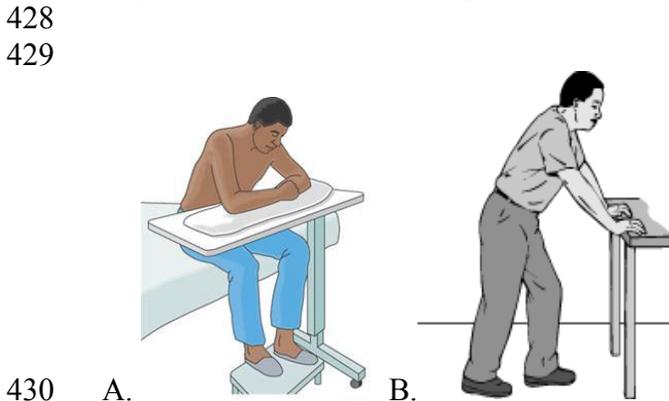
418 BLE = bilateral lower extremity, lb = pounds, sec = seconds, BUE = bilateral upper extremity,  
 419 mins = minutes, ft = feet, sec=seconds, RB = rest break, 2WW = two-wheeled walker,  
 420 4WW=four-wheeled walker (rollator), 6MWT=6-Minute Walk Test, d/wk = days per week,  
 421 BOS = base of support.

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 423 **Table 5: Patient Outcomes**

Outcome Measure	Initial Evaluation	Progress Note (Week 2)	Discharge (Week 3)
<b>6MWT</b>	140.8 m	160.9 m	176.8 m
<b>BLE gross strength</b>	3+/5	4-/5	4/5
<b>Dynamic Standing Balance</b>	Fair +	Fair +	Good
<b>Stairs</b>	N/A	N/A	1x5 straight cane
<b>Transfers</b>	CGA 25% VC	CGA 10% VC	I 0% VC

424 6MWT=6-Minute Walk Test, BLE = bilateral lower extremity, CGA=contact guard assist,  
 425 I=independent, VC=verbal cueing, m=meters

426  
 427 **Figure 1: Positions for Dyspnea Relief**



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432 **APPENDICES (Supplemental tables and figures beyond max of six)**

433 **Appendix 1: Patient Medication List<sup>22</sup>**

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<b>Medications</b>	<b>Purpose/Diagnosis</b>	<b>435</b>
Lasix 40 mg via IV	Hypertension	436
Magnesium Oxide 400 mg	Dietary Supplement	437
Wellbutrin SR 150 mg	Depression	438
Celebrex 200 mg	Arthritis	439
Protonix 40 mg	GERD	440
Nebulized gentamicin	Pneumonia	441
Perforomist	Asthma/COPD	442
Xopenex	Asthma/COPD	443
Budesonide	Asthma/COPD	444
Spiriva	Asthma/COPD	445
Lovenox 40 mg	Anticoagulant	446
Synthroid 125 mcg	Hypothyroidism	447
Solumedrol 60 mg via IV	Asthma	448
Zithromax 500 mg	COPD	449
Singulair 10 mg	Asthma	450
Zoloft	Depression/Anxiety	451

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454 **Appendix 2: Manual Muscle Testing Grades<sup>13</sup>**

<b>Function of the Muscle</b>	<b>Grade</b>
No contractions felt in the muscle	0
Tendon becomes prominent of feeble contraction felt in the muscle, but no visible movement of the part	1
<b>MOVEMENT IN HORIZONTAL PLANE</b>	
Moves through partial range of motion	2-
Moves through complete range of motion	2
<b>ANTIGRAVITY POSITION</b>	
Moves through partial range of motion	2+
Gradual release from test position	3-
Holds test position (no added pressure)	3
Holds test position against slight pressure	3+
Holds test position against slight to moderate pressure	4-
Holds test position against moderate pressure	4
Holds test position against moderate to strong pressure	4+
Holds test position against strong pressure	5

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458 **CARE Checklist**

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<b>CARE Content Area</b>	Page
<b>1. Title</b> – The area of focus and “case report” should appear in the title	1
<b>2. Key Words</b> – Two to five key words that identify topics in this case report	1
<b>3. Abstract</b> – (structure or unstructured) a. Introduction – What is unique and why is it important? b. The patient’s main concerns and important clinical findings. c. The main diagnoses, interventions, and outcomes. d. Conclusion—What are one or more “take-away” lessons?	2-3
<b>4. Introduction</b> – Briefly summarize why this case is unique with medical literature references.	3-4
<b>5. Patient Information</b> a. De-identified demographic and other patient information. b. Main concerns and symptoms of the patient. c. Medical, family, and psychosocial history including genetic information. d. Relevant past interventions and their outcomes.	4-6
<b>6. Clinical Findings</b> – Relevant physical examination (PE) and other clinical findings	6-8
<b>7. Timeline</b> – Relevant data from this episode of care organized as a timeline (figure or table).	11
<b>8. Diagnostic Assessment</b> a. Diagnostic methods (PE, laboratory testing, imaging, surveys). b. Diagnostic challenges. c. Diagnostic reasoning including differential diagnosis. d. Prognostic characteristics when applicable.	7-8
<b>9. Therapeutic Intervention</b> a. Types of intervention (pharmacologic, surgical, preventive). b. Administration of intervention (dosage, strength, duration). c. Changes in the interventions with explanations.	9-11
<b>10. Follow-up and Outcomes</b> a. Clinician and patient-assessed outcomes when appropriate. b. Important follow-up diagnostic and other test results. c. Intervention adherence and tolerability (how was this assessed)? d. Adverse and unanticipated events.	12
<b>11. Discussion</b> a. Strengths and limitations in your approach to this case. b. Discussion of the relevant medical literature. c. The rationale for your conclusions. d. The primary “take-away” lessons from this case report.	12-14
<b>12. Patient Perspective</b> – The patient can share their perspective on their case.	5-6
<b>13. Informed Consent</b> – The patient should give informed consent.	1