

## Editorial

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# The Importance of Rehabilitation before and after Lung Transplantation

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Lung transplantation (LTx) has gained widespread acceptance as a therapeutic option for end-stage pulmonary disease. LTx has been shown to improve quality of life (QoL) and survival in individuals with various end-stage lung diseases.

However, numerous studies have been demonstrated that LTx recipients experience persistent impairments in exercise capacity and skeletal muscle function despite a vast improvement in lung function after LTx.<sup>1-7</sup> Persistent limitations in exercise capacity and skeletal muscle function have been observed for more than 1 year after transplantation.<sup>8</sup>

Investigations of muscle function in LTx recipients reveal decreased muscle mass and strength, reductions in type I fiber proportion, decreased calcium uptake and release, decreased mitochondrial enzyme activity, and impaired oxidative capacity of the peripheral muscles.<sup>1</sup>

Similarly, poor daily physical activity has been studied in heart and kidney recipients. Heart recipients were classified as very sedentary, based on accelerometer measurements.<sup>9</sup> Children and adolescents with renal transplants have severely impaired cardiorespiratory fitness and physical activity compared with their healthy counterparts.<sup>10,11</sup>

In these patients, inactivity prior to transplantation and resulting pre-transplant deconditioning are likely to influence functional recovery after surgery. Repeated episodes of infection and rejection, use of anti-inflammatory and immunosuppressive drugs and a sedentary life style are possible post-transplant contributing to limitations in the physical fitness.

In LTx patients, pulmonary function is only partially related to participation in daily physical activities. For a given limitation in pulmonary function a considerable variability in daily physical activity was found. Of all measured variables the six minutes walking distance (6MWD) showed the strongest association with participation in daily physical activity. Good correlations between 6MWD and both minutes in activities 2 METs and number of steps were observed.<sup>12</sup>

A systematic review was undertaken to examine the evidence for exercise training on functional outcomes in LTx recipients.<sup>1</sup> Some evidence was found to support that a period of structured exercise training could improve maximal and functional exercise capacity, skeletal muscle strength, and lumbar bone mineral density in LTx recipients.<sup>1</sup>

Rehabilitation is also important in the pre-operative management of patients.<sup>13</sup> The importance of pre-transplant rehabilitation has been shown in the latest joint American Thoracic Society (ATS)/European Respiratory Society (ERS) official statement on pulmonary rehabilitation.<sup>14</sup> Before LTx, while patients wait for surgery, rehabilitation was found to improve exercise tolerance and activities of living, without any significant change in respiratory function.<sup>15</sup> Pulmonary rehabilitation improves physical fitness of pulmonary failure patients who are on waiting list for lung transplantation, meanwhile some of the candidates could deviate from the LTx waiting patients list.<sup>15</sup> Moreover, reduced cardiorespiratory fitness was associated with the clustering of cardiovascular risk factors. Routine counseling for increased physical

activities is strongly recommended.

Further studies are needed to determine the potential for exercise training to optimize these functional outcomes and to develop optimal guidelines for exercise prescription in the LTxs population.<sup>16</sup>

#### CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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