Osteoporosis in Lung Transplantation Candidates: Association With 6-minute Walking Test and Body Mass Index

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ABSTRACT

Background. Osteoporosis is a well-recognized complication in lung transplantation because of steroid use and immobilization. The aim of the study was to assess the prevalence of osteoporosis and risk factors associated with osteoporosis in lung transplantation candidates.

Methods. The bone mineral density of 174 patients with various end-stage lung diseases was assessed at the pretransplantation period. Osteoporosis risk factors were analyzed with the consideration to principal diagnosis, demographic, and clinical parameters of lung disease, lung function tests and mobility test (6-minute walking test). A multivariate analysis was conducted to determine various demographic and clinical risk factors associated with bone mass loss in the pretransplant period.

Results. The prevalence of osteoporosis and osteopenia was 46% and 35%, respectively, in the study population. Osteoporotic patients have lower body mass index and lower 6-minute walking distance than patients without osteoporosis. In addition, they have higher pulmonary artery pressure and history of noninvasive mechanical ventilation than in patients without osteoporosis. There was a significant negative correlation between the 6-minute walking test, body mass index, and the presence of osteoporosis in the study population. Multivariate logistic regression analysis confirmed that 6-minute walking test (odds ratio, 0.996) and body mass index (odds ratio, 0.847) were significantly and negatively correlated with the presence of osteoporosis.

Conclusions. A significant proportion of patients with end-stage lung diseases have osteopenia or osteoporosis pretransplantation. This is the first study to demonstrate that 6-minute walking distance and bone mineral density independently predict osteoporosis in lung transplant candidates.

TRANSPLANTATION is a well-established therapy for end-stage diseases of the kidney, lung, liver, and heart among others [1]. The first successful lung transplantation operation was performed in 2009 in Turkey. As progress in both the surgical and medical management of lung transplant patients lead to prolonged survival, the issue of their posttransplant quality of life has become increasingly important [2]. Although it is a life-saving measure, transplantation is associated with the well-recognized complication of osteoporosis [1]. Bone mass decrease is a significant and well-known side effect of immunosuppressive therapy. The magnitude of bone mass decrease associated with lung transplantation, however, has been poorly studied to date.

The 6-minute walking test (6MWT) has been used on clinical settings to explore exercise capacity at submaximal exercise levels and to evaluate the effects of treatment in patients with a variety of pulmonary disease [3]. The test is

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easy to apply, better tolerated than some other tests, and is reflective of physical activities. According to the American Thoracic Society guideline, the test was designed to determine the integrated responses of the body systems including pulmonary and cardiovascular systems, neuromuscular units, and muscle metabolism [4].

The aim of the study was to (1) assess the prevalence of osteoporosis before lung transplantation including patients with all kinds of end stage lung disease, (2) determine whether general accepted risk factors for osteoporosis (age, gender, body mass index [BMI]) play a role in patients awaiting lung transplantation, and (3) investigate whether there is a correlation between clinical and functional parameters and pretransplant bone mass.

METHODS

Study Population

We included patients with a diagnosis of end-stage lung disease who were referred as lung transplant candidates to the lung transplantation unit of Kartal Kosuyolu Training Hospital between January 2012 and April 2015. The study was approved by the local ethics committee, and all participants gave written informed consent.

Data Collection

Demographic data, weight, height, BMI, time of diagnosis, arterial blood gas analysis, history of noninvasive mechanical ventilation (NIMV) treatment, smoking history, and 6MWT results were collected from patients' records. The study design is summarized in Fig 1.

The 6MWT was performed according to American Thoracic Society guideline criteria by a physiotherapist with the specific experience while the subjects had their usual oxygen flow. The test was performed in a 30-m corridor by a physiotherapist with specific experience. The course was demarcated by 2 traffic cones, and the corridor was marked every 3 m, according to the American Thoracic Society standards. Instructions and verbal encouragement given to the subjects were standardized. Encouragement was given every minute during the test until subject reached exhaustion. The end of the test was determined either by the subject, for any reason, or by

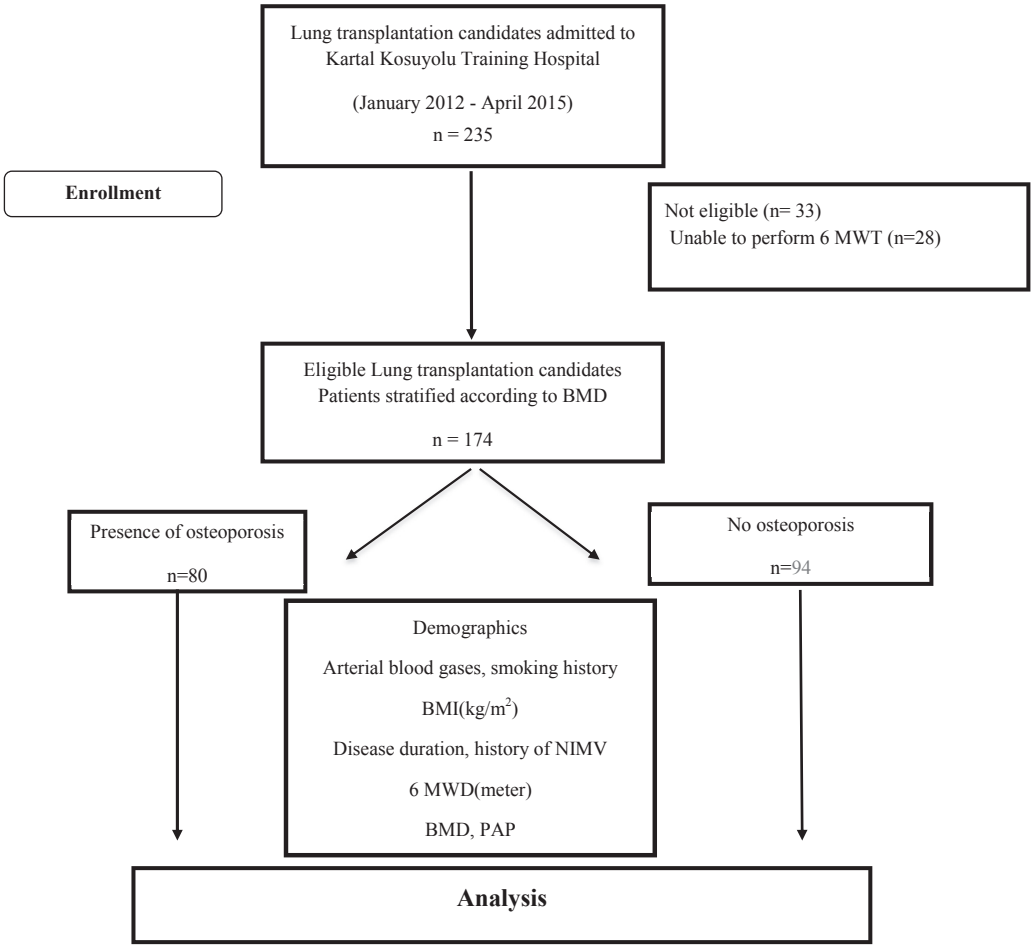

Fig 1. Consort diagram showing patient enrollment, follow-up, and analysis. BMI, body mass index; BMD, bone mineral density; 6 MWT, 6-minute walking test; 6 MWD, 6-minute walking distance; PAP, pulmonary artery pressure; NIMV, noninvasive mechanical ventilation.