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# Pneumonectomy: Post-operative quality of life and lung function

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**Summary**
*Background:* Pneumonectomy is associated with high morbidity and mortality. After pneumonectomy, data on health-related quality of life (HRQoL) or its correlation with dyspnea and lung function are scarce. Our main aim was to evaluate long-term HRQoL after pneumonectomy.
*Methods:* In a retrospective one-center cross-sectional study, we investigated 31 of 98 patients who underwent pneumonectomy between January 1997 and October 2003 due to primary lung cancer. Pre- or postoperative chemotherapy or radiotherapy was applied according to hospital protocol. In June 2004, all patients alive received the generic HRQoL instrument (15D), as well as the Baseline Dyspnea Index (BDI). Results of the 15D were compared with those for an age- and gender-standardized general population. In April 2005, 20 patients participated in follow-up spirometric pulmonary function tests.
*Results:* The 15D total score and its various dimensions were significantly lower after pneumonectomy than in the general population. Females both in 15D score and in the BDI had more dyspnea ($p < 0.05$). No difference appeared between right and left pneumonectomy patients, except for more prominent dyspnea in women with right-sided pneumonectomy.

*Abbreviations:* AFV, area under the expiratory flow volume curve; BDI, baseline dyspnea index; COPD, chronic obstructive pulmonary disease; $DL_{CO}$, diffusing capacity of the lung for carbon monoxide; $FEF_{25-75}$, flow rate at the middle part of FVC; $FEV_1$, forced expiratory volume in 1 s; FVC, forced vital capacity; HRQoL, health-related quality of life; PFTs, pulmonary function tests; PN, pneumonectomy; ppo-$FEV_1$, predicted postoperative forced expiratory volume in 1 s; QoL, Quality of life

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*Conclusions:* Pneumonectomy had a negative impact on patients' HRQoL. The use of a broad HRQoL instrument like the 15D, which covers multiple dimensions of HRQoL, yields a more accurate evaluation than did a single-dimension HRQoL instrument. Possibilities for sleeve-resection should be considered thoroughly before any pneumonectomy.
*Summary:* Quality of life (QoL) after pneumonectomy, as measured with a generic QoL instrument, the 15D, was compared in an age- and gender-standardized population. QoL after pneumonectomy was significantly lower, especially in women after right-sided pneumonectomy.


## 1. Introduction

In surgical treatment of lung cancer, pneumonectomy (PN) is performed in about 10% of patients [1]. Regardless of advancements in perioperative care, surgical mortality and morbidity are higher than in lobectomy, mortality rates being from 5 to 10% [2—6]. Of these patients, 40—60% face postoperative complications, cardiovascular complications predominating. Other complications include ones such as respiratory infections, bronchopleural fistula, recurrent laryngeal palsy, delayed extubation, and pulmonary embolus [7—9].

HRQoL of PN patients have not been studied extensively. Previous studies have focused on the HRQoL after lobectomy [10—12]. Traditional means of postoperative assessment such as survival rate and improvement in disease-related symptoms ignore patients' subjective perception of health-related quality of life (HRQoL) or well-being. The main problem in preoperative evaluation of PN patients' long-term HRQoL is that the functional impairment is not due solely to the amount of resected lung parenchyma [13,14]. Tobacco use, aging, and comorbid conditions also affect respiratory symptoms and pulmonary function [15,16]. In chronic lung diseases, e.g., in chronic obstructive pulmonary disease (COPD), HRQoL is significantly associated with respiratory symptoms [17—20]. In lung cancer, gender differences in self-perception of respiratory symptoms have also occurred [21,22]. Overall, after thoracotomy for lung cancer, HRQoL has been associated with varying degrees of compromised pulmonary function and exercise capacity [23,24].

The aim of this study was to compare the long-term HRQoL after pneumonectomy to that of an age- and gender-standardized sample of the general population. The second aim was to assess the validity of a generic HRQoL instrument, the 15D [25], in patients who had undergone PN, and to determine the correlation of this instrument's results with those of Mahler's Baseline Dyspnea Index [26] (BDI). The third aim was to evaluate the role of pre- and postoperative spirometric lung function tests as predictors of long-term HRQoL and of dyspnea.

## 2. Patients and methods

Between January 1997 and October 2003, 98 patients underwent pneumonectomy for non-small cell lung cancer in the Department of Cardiothoracic Surgery, Helsinki University Central Hospital. Of 34 surviving patients, the study group included 31 patients who replied to the 15D, and the BDI questionnaires in June 2004. The median time from surgery to query was 33 months (range: 8—86 months). In only 3 patients was the time less than 12 months. The clinical characteristics of both the study group ($n = 31$) and all the 98 patients who were originally operated on are provided in Table 1.

Of 31 patients, 9 were women. The histological subtype for 15 was squamous cell carcinoma, for 14 adenocarcinoma, for one each large cell or bronchioloalveolar carcinoma. Six patients had earlier been diagnosed with hyperlipidemia, five with hypertension, two with COPD, and one with diabetes mellitus. Two patients were never-smokers, and 29 had smoked over 20 pack-years. Eight received neoadjuvant chemotherapy and one adjuvant chemotherapy. Postoperative radiation was given to four. Left PN was conducted in 18 (six women), and right PN in 13 (three women). Lymphadenectomy or pericardial resection or both were conducted in nine patients. Marked postoperative complications including postoperative pain, recurrent nerve paresis, infections, and bronchopleural fistulas occurred in 13 (37.1%). One re-thoracotomy was performed for an infected hemothorax. All 31 patients were followed up using normal hospital protocol.

Non-respondents were also contacted by phone by an independent interviewer. The HRQoL data for the general population ($n = 3336$) measured by the 15D came from the Health 2000 Survey, and was matched for the age and gender of the patient group [27]. The smoking prevalence in Finland is 29% in men and 18% in women [27].

### 2.1. Pulmonary function tests

Preoperative pulmonary function tests (PFTs) data from spirometric studies ($FEV_1$, FVC, and $FEV_1/FVC$), and pulmonary diffusion capacity measurements ($DL_{co}$) were recorded from patients' medical records. Diffusion capacity of the lungs for carbon monoxide ($DL_{co}$) was measured preoperatively by the single-breath method, by Master Lab (Erich Jaeger; Wurzburg, Germany). Predicted postoperative forced expiratory volume in 1 s (ppo-$FEV_1$) was calculated based on preoperative $FEV_1$ dynamic flow-spirometry together with radiospirometry [28,29].

Postoperative flow-volume spirometry was conducted in 20 patients between March and May 2005 (Table 2). Median time from surgery to PFTs was 39.4 months (range: 18—95). For spirometry, a flow-volume spirometer was connected to a microcomputer system (Medikro 202; Medikro Oy; Kuopio, Finland), with measurement performed according to European Respiratory Society (ERS, 1993) recommendations. Results were recorded from the envelope curve of at least three superimposed forced expiratory flow-volume curves. $FEV_1$, FVC, flow rate in the middle of FVC ($FEF_{25-75}$), and area under the expiratory flow volume curve (AFV) were