Survival and quality of life at least 1 year after pneumonectomy

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Objective: Quality of life after pulmonary resection is becoming an increasingly important part of the conversation between patients and surgeons. Pneumonectomy is often called a *disease*. The objective of this study was to assess the physical and mental aspects of patients' quality of life at least 1 year after pneumonectomy.

Methods: Quality of life was ascertained using the Short Form-12 (SF-12) survey on a consecutive series of patients who were at least 1 year postoperative from a pneumonectomy. Both the physical and mental component scores of the quality-of-life survey were obtained and compared.

Results: There were 152 patients who underwent pneumonectomy between January 1997 and December 2010 by the same surgeon (104 for non–small cell lung cancer); 111 patients met the eligibility criteria. Mean survival was 3.4 years and the overall 5-year Kaplan-Meier survival was 38%. Responses to the quality-of-life survey were obtained in 108 of 111 patients (98%) who were at least 1 year postoperative. The overall quality-of-life score was comparable with that of the healthy population and patients with chronic diseases. The mean physical component score was significantly lower than that of the healthy population score ($P = .04$); the mental quality-of-life score was higher than those for patients with certain chronic diseases such as liver or kidney disease ($P = .05$). After multivariate analysis, only age remained a significant predictor of the physical component score.

Conclusions: Pneumonectomy is tolerated in carefully selected patients. The physical quality-of-life score 1 year after resection is significantly lower than the average population, yet the mental score in these patients is higher. Future studies on quality of life should be considered for all medical therapies, and stratification of the mental score from the physical score should be reported. (J Thorac Cardiovasc Surg 2012;144:1139-45)

GTS

Quality of life (QOL) is becoming an increasingly important part of the conversation between patients and physicians. Most patients are willing to accept the risks of immediate postoperative complications, yet not the risks of potential long-term functional disability after lung resection. Patients want reassurance that they will not be left physically or mentally handicapped and will be able to carry out activities of daily life after pulmonary resection.[1]

Pneumonectomy is often referred to as a *disease*. Graham and Singer[2] reported the first successful pneumonectomy at the American Association of Thoracic Surgery annual meeting in 1933. Since that initial presentation, there remains much controversy surrounding this operation not only in terms of early postoperative mortality, but with regard to the long-term detrimental impact on QOL.[3-5] Many clinicians argue that patients who undergo pneumonectomy subsequently have a poor QOL, and therefore surgeons should only select it as a last option.[6,7]

Few reports have evaluated the long-term ($\geq$1 year postoperatively) mental and physical components of QOL in larger postpneumonectomy cohorts. The objective of this study was to assess the postoperative mental and physical QOL scores using the Short Form-12 (SF-12) survey in a consecutive series of patients who underwent pneumonectomy $\geq$1 year after pneumonectomy.

METHODS

This was a prospective cross-sectional study to evaluate the long-term impact on QOL of a consecutive series of patients who underwent pneumonectomy by the same general thoracic surgeon (R.J.C.). Pneumonectomy was performed on patients with non–small cell lung cancer only if sleeve resection of the bronchus or artery could not render a negative margin. We have reported previously our indication and workup for patients with non–small cell lung cancer and our technique for attempting sleeve resections of the artery and bronchus.[8,9] No absolute threshold for a postoperative predicted percent diffusing capacity of the lung for carbon monoxide (DLCO%) or percent forced expiratory volume in 1 second (FEV_1%) was used below which pneumonectomy was denied; however, in general, a postoperative predicted DLCO of 30% and a postoperative predicted FEV_1 of 30% was used. Patients who were <19 years of age at the time of surgery were excluded from this study. In addition, pneumonectomy was sometimes performed for patients with benign disease with a destroyed lung. These patients were included in this study to elucidate more clearly the difference between cancer patients and those with inflammatory disease. The indications for

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Abbreviations and Acronyms

DLCO = diffusing capacity of the lung for carbon monoxide
FEV_1 = forced expiratory volume in 1 second
IRB = institutional review board
QOL = quality of life
PFT = pulmonary function test
SF-12 = Short Form-12
SF-12 = Short Form-36

pneumonectomy for inflammatory diseases have been described previously.[10] Prior to pneumonectomy, patients underwent pulmonary function tests (PFTs), computed tomographic scan, ventilation/perfusion scan, and echocardiogram, and were asked to assess their own performance status using the Eastern Cooperative Oncology Group performance status score.[11]

Starting in 2003, the SF-12 survey was administered to all patients who had undergone a pneumonectomy since 1996. After 2003 the survey was administered prospectively to patients 1 year after they underwent a pneumonectomy. SF-12 is a shorter version of the standard Short Form 36 (SF-36), and it is also a validated tool used to assess the patient's QOL; it permits calculation of a physical component score and a mental component score.[12] Appendix 1 shows the SF-12 survey used in this study. Responses were stratified by the physical and mental components scores; these scores range from 0 (lowest level of health) to 100 (highest level of health). The national normalized value (as validated by Quality Metric Inc, Lincoln, RI) is 50.0 with a standard deviation of 10.[13] Mental and physical component scores of these patients were compared with scores obtained for healthy patients; the general U.S. population; and patients with diabetes, hypertension, and liver or kidney diseases as reported by the National Survey of Functional Health Status.[12] A higher mental component score indicates a positive effect, absence of psychological distress, and limitations in usual social or role activities as a result of emotional problems; a higher physical score indicates fewer physical limitations, disabilities, or decrements in well-being as well as a high energy level.[13]

Major morbidity was defined as we have described previously.[8] Operative mortality was defined as death within 30 days of the operation or prior to discharge. Information was obtained through hospital databases, medical records, and/or family reports. Data were exported from Excel (Microsoft Corp, Seattle, Wash) to SAS version 9.1 (SAS Institute, Cary, NC) software. Descriptive statistics were used to estimate the frequency of categorical and median of the continuous study variables. Subgroups analysis, which consisted of comparison of mental and physical scores stratified by age, gender, indication for operation, final pathologic stage, neo-adjuvant therapy, and comorbidity, were performed by means of the Mann-Whitney *U* test. Comparisons were done with paired, 2-tailed *t* tests for means of normally distributed continuous variables and Wilcoxon rank sum tests for skewed data. Either the χ^2 or the Fisher exact test was used to compare categorical data. A stepwise multivariate logistic regression model was used to assess for any correlation of QOL score with subgroups. The University of Alabama at Birmingham's institutional review board (IRB) approved this protocol (E100827024) as well as the prospective database (X030403013) used to collect information for this study. Individual consent was waived for inclusion in this study; however, it was required and obtained to enter patient data in the prospective database.

RESULTS

Between January 1997 and December 2011, 152 patients underwent a pneumonectomy. Of the 152 patients, 2 patients were excluded as a result of age <19 years, 11 patients died within 90 days of surgery, and 29 patients died within 1 year of surgery, thus leaving 111 patients eligible for this study. The characteristics of these 111 patients are shown in Table 1. A major postoperative morbidity occurred in 37 patients (23%), including the 10 patients (6.7%) who had an operative mortality. The mean survival was 3.4 years and the overall 5-year Kaplan-Meier survival was 37%.

Responses to the SF-12 QOL survey were obtained in 108 of the 111 patients (98%) who were alive at least 1 year postoperatively. Table 2[13] shows that the mean physical component score in our cohort was significantly lower than that of the average U.S. population's score ($P = .02$), whereas the mental QOL score was significantly higher ($P = .03$).

Univariate analysis of patient characteristics showed that mental QOL differed significantly b: gender (females had a higher mental component score than males, $P < .001$), indication for surgery (patients who underwent resection for malignancy had a higher mental score, $P < .001$), and disease recurrence (patients who had a recurrence had lower mental scores). There was no significant difference observed based on age, preoperative PFTs, neo-adjuvant therapy, final pathologic stage, smoking status, or comorbidity. On multivariate analysis, none of these factors remained significantly associated with the mental QOL score. Univariate analysis showed that physical QOL differed significantly by age (older patients had a lower physical component score, $P = .01$), FEV1% score (patients with a higher FEV1% had a higher physical component score, $P < .001$), and indication for surgery (patients undergoing surgery for malignancy had a higher physical score, $P = .05$). There were no significant differences observed based on gender, DLCO%, neo-adjuvant therapy, final pathologic stage, smoking status, comorbidity, or recurrence. On multivariate analysis, only age remained significantly associated with the physical component score ($P = .02$).

DISCUSSION

General thoracic surgeons try to avoid pneumonectomy in patients with lung cancer because of the reported poor QOL, increased morbidity and mortality, and the impression that a pneumonectomy is, in and of itself, a disease. However, sometimes a pneumonectomy is the only way to achieve an R0 resection. In general, it should be reserved for patients who are N2 lymph node negative, have acceptable pulmonary and cardiac function, and suitable performance status. Interestingly, pneumonectomy is often not offered for patients who have a metastatic lesion to the lung because of the opinion that it offers only local control and it has an associated poor QOL. The perception that a patient postpneumonectomy has a poor QOL secondary to physiologic impairment was the impetus for this study.