LUNG CANCER

Quality of life following lung cancer surgery

G Myrdal, S Valtysdottir, M Lambe, E Ståhle

Thorax 2003;**58**:194–197

See end of article for authors' affiliations

Correspondence to: Dr G Myrdal, Department of Thoracic and Cardiovascular Surgery, Uppsala University Hospital, SE-751 85 Uppsala, Sweden; gunnar.myrdal@thorax.uas.lul.se

Revised version received 21 August 2002
Accepted for publication 25 September 2002

Background: Patients with non-small cell bronchogenic carcinoma have a limited survival. Quality of life (QoL) is therefore an issue of importance in this group of patients. The aim of the present study was to evaluate QoL in lung cancer patients after open surgery.
Methods: During a 4 year period (1997–2000) 194 patients with primary bronchogenic carcinoma of the lung underwent surgery at the Department of Thoracic and Cardiovascular Surgery in Uppsala, Sweden; 132 patients were alive on 1 April 2001. These patients received the Short Form-36 (SF-36) health questionnaire, Hospital Anxiety and Depression (HAD) scale, and special questions related to pulmonary symptoms (response rate 85%). Patients who underwent coronary bypass surgery (CABG) served as a comparison group (response rate 91%). Corresponding estimates of QoL in healthy controls were obtained from the SF-36 manual for the Swedish population.
Results: Lung cancer patients differed from CABG patients in only one subgroup of the SF-36 (role physical), but had poorer QoL than healthy controls. No difference in anxiety was found between the lung cancer patients and the CABG patients, but the latter were more likely to suffer from depression (5.0% *v* 3.0%). Current smokers scored lower in the mental health dimension assessment.
Conclusion: Lung cancer patients who undergo open traditional surgical resection have a QoL comparable to that of CABG patients. Lung cancer patients have poorer physical function because of reduced pulmonary function, but show no sign of increased anxiety or depression. Those who continued to smoke after surgery had impaired mental health.

Radical resection is the treatment of choice of those currently available for non-small cell lung cancer,[1] but only about 10–20% of all lung cancer patients are eligible for surgery.[2] Very little progress has been made in attempts to improve the long term survival in this group of patients. Depending on the completeness of the surgical resection and tumour stage, 20–75% of patients are alive 5 years after surgery intended to cure.[1] Important information on how individuals are affected by disease can be obtained through quality of life (QoL) measurements using different instruments and symptom profiles. QoL has been assessed in various patient groups, but very little is known about the QoL following lung cancer surgery.

The purpose of the present study was twofold: (1) to compare QoL and psychiatric symptoms (anxiety and depression) in patients with primary lung cancer, potentially cured by surgery, with those in patients who have undergone coronary artery bypass grafting (CABG) and healthy controls; and (2) to identify clinical characteristics that may indicate patients at risk of having impaired QoL after lung cancer surgery.

METHODS

Patient populations

Between 1 January 1997 and 31 December 2000 a total of 194 patients underwent open surgery for lung cancer (non-muscle sparing posterolateral incision) with intention to cure at the Department of Thoracic and Cardiovascular Surgery of the University Hospital, Uppsala, Sweden. All patients eligible for curative surgery were evaluated preoperatively with a CT scan and considered to have local resectable disease. Patients with suspected pathological lymph nodes in the mediastinum underwent mediastinoscopy and, if positive lymph nodes were found, the patient was excluded from surgery. All 194 patients were followed up in terms of survival by computerised linkage to two national registers, the Swedish Cause of Death Register and a continuously updated population register. Using these databases, 132 patients could be identified as being alive on 1 April 2001. These patients received questionnaires to evaluate their quality of life. As a comparison group, patients who underwent coronary artery bypass grafting (CABG) by median sternotomy, matched for time since surgery, age and sex, were identified in a hospital database. CABG patients were chosen as controls because they had also undergone thoracic surgery and several previous studies have addressed QoL in this group.[3 4]

Three sets of questionnaires were used. All the patients received the Swedish version of Short Form-36 (SF-36),[5] the Hospital Anxiety and Depression (HAD) scale,[6] and lung specific questions by mail, followed by a reminder 3 weeks later. Swedish normal population scores (n=8930) obtained from a health survey in 1998[7] were used to generate mean values matched for age and sex. These mean values were used for comparison with mean SF-36 scores for the lung cancer and CABG groups of patients. Five of the 112 patients with lung cancer had received adjuvant chemotherapy and this treatment was terminated before the time of the study in all five.

The study was approved by the ethics committee at the Uppsala University Hospital.

Quality of life instruments

The SF-36 instrument is designed to evaluate health related quality of life in multiple groups of patients. It is composed of 36 items, grouped into eight scales, which include both physical and mental health and assesses eight dimensions of quality of life. The raw subscale scores are standardised and range from 0 to 100 where 0 represents the poorest state of health and 100 the best possible. Two summary scores are also calculated—the physical component summary scores (PCS) and the mental component summary scores (MCS)—to summarise the physical and mental state of health.

The HAD scale is a brief self-administered rating scale which was designed to measure anxiety and depression in somatically ill individuals. The questionnaire contains 14 items for self-assessment on a scale of 0–3. Seven questions are related to anxiety and seven to depression, with a scale

Table 1 Patient characteristics

	Lung cancer (n=112)	CABG (n=121)
M:F	57:55	64:57
Age (years)		
<70	55 (51%)	62 (51%)
≥70	57 (49%)	59 (49%)
Smoking habits		
Never smoked	21 (19%)	45 (37%)
Stopped smoking	78 (70%)	68 (56%)
Still smoking	13 (11%)	8 (7%)

Lung cancer patients had undergone open posterolateral (non-muscle sparing) thoracotomy with intention to cure.
CABG=patients who had undergone coronary artery bypass grafting.

range of 0–21 for both variables. A score of eight or more on each subscale represents "possible" psychiatric morbidity and a score of 11 or more represents "definite" clinical anxiety or depression. The depression subscale has been constructed so that somatic items are largely excluded.

Three lung specific questions were used: patients were asked to rate the presence of pain in the chest, breathlessness, and cough on a scale of 1–4 during the last week. Patients also answered questions about their smoking history.

Statistical methods

After being tested, the parameters used were considered to be normally distributed. The raw scores in the SF-36 scale were calculated for all 233 patients and converted to a 0–100 scale using the formula specified in the scoring manual for SF-36.[5] The descriptive statistics are presented as means. ANOVA tests were used to compare mean SF-36 scores between groups (lung cancer patients, CABG patients, and healthy controls) and *t* tests were used to test correlations between clinical characteristics of lung cancer patients and their QoL with the aim of identifying clinical factors that might be related to impaired QoL.

Significance levels with a p value of <0.05 were considered to be statistically significant. Six patients in the lung cancer group and two patients in the CABG group failed to respond to all SF-36 questions (1–2 misses out of five alternatives). For the missing values a scoring algorithm was used.[5]

For the pathological staging of lung cancer the staging system from 1997[8] was used with stage Ia as reference. Forced expiratory volume in 1 second (FEV_1) was measured with a Masterlab body plethysmograph with adjustment for age and body size.[9 10] The SAS 6.12 statistical procedure (SAS Institute) was used for statistical calculations.

RESULTS

The mean age of both groups of patients was 67 years (range 47–85 years in the CABG patients and 28–84 years in the lung cancer patients). The characteristics of the patients are shown in table 1. The median follow up time since surgery was 23 months (range 4–48) in both groups. The mean (SD) follow up time for lung cancer patients was 22.5 (12.1) months and for CABG patients was 22 (12.3) months. Twenty two patients with lung cancer (22%) underwent pneumonectomy, 85 (76%) underwent lobectomy, and five segmentectomy; 33% of the lung cancer patients had FEV_1 lower than 60% of the expected preoperatively. At the time of surgery 67% were categorised as stage I, 17% as stage II, and 16% as stage IIIa. The response rate was 85% (112 of 132) in the lung cancer patients and 91% (121 of 132) in the CABG group.

SF-36 scores

Deviation from norms

Patients who had undergone lung cancer surgery deviated significantly from the normative data for the general Swedish population in seven of the eight SF-36 subscales and on both summary component scales (table 2). The only SF-36 subscale in which they did not deviate was body pain (table 2).

Comparison of scales by diagnosis

There was a significant difference between the lung cancer and CABG patients in terms of physical function, with a difference of 9.5 between the mean values (table 2).

Correlation between clinical data and postoperative SF-36 scores in lung cancer patients

Patients who continued to smoke after lung cancer surgery had significantly lower scores for mental health (p=0.003), vitality (p=0.027) and mental components summary (p=0.003) than former smokers who stopped smoking at the time of surgery or before and those who had never smoked (fig 1). There was a significant correlation between reduced lung function (FEV_1 <60% before surgery) and the physical summary components score (p=0.05). Furthermore, patients who underwent pneumonectomy had a significantly lower score for physical summary components (p=0.002) and role emotional (p=0.02) than those who had undergone lobectomy. The SF-36 scores showed no correlation with sex, age, tumour stage, or length of time since surgery.

Hospital Anxiety and Depression (HAD) scale

Anxiety subscale

There was no difference in anxiety between the two groups of patients. The mean score on the HAD subscale for anxiety was 4.96 in the lung cancer patients; 25% had a score representing possible clinical anxiety (≥8). The score for the CABG patients was 4.89, with 24% in the range indicating possible anxiety. Ten per cent of lung cancer patients and 11% of CABG patients had a score of ≥11 reflecting definite anxiety.

Depression subscale

The mean score on the HAD depression subscale was 4.02 in patients with lung cancer and 3.84 in CABG patients. Twenty per cent of the patients in both groups had a score representing probable clinical depression (≥8). Three per cent of lung cancer patients and 5% of CABG patients had a score of ≥11 reflecting definite depression. There was no significant difference in the rate of definite depression between the two groups (3% in lung cancer patients and 5% in CABG patients, p=0.18).

Correlations between different components

Significant correlations were noted between the mean scores on the anxiety and depression subscales of the HAD scale and in the mental components summary score of the SF-36 (p<0.001) in both the lung cancer and CABG groups of patients.

Specific questions

Breathlessness

Breathlessness on physical effort was significantly more pronounced in patients with lung cancer than in the CABG patients (p<0.001), but no such difference was found for breathlessness at rest.

DISCUSSION

Evaluations of the impact of different interventions on QoL measurements have gained increasing attention in recent years. These have been achieved by assessing the effects on different factors—for example, mobility, mood, cognitive function, social roles, and general life satisfaction. Several

Table 2 Mean (95% CI) SF-36 scores for 112 patients with primary lung cancer who underwent open surgery compared with the normal population and 121 patients who underwent coronary artery bypass grafting (CABG)

SF-36 dimension	Operated lung cancer patients	Difference in mean compared with normal population	Difference in mean compared with CABG
Physical function (PF)	61.1 (56.4 to 65.8)	10.9 (5.2 to 16.5)*	9.5 (2.6 to 16.3)*
Role physical (RP)	45.0 (36.9 to 53.1)	20.2 (10.3 to 30.1)*	7.1 (–5.3 to 19.6)
Body pain (BP)	72.3 (66.8 to 77.8)	3.9 (to 2.4 to 10.3)	1.4 (–7.7 to 8.0)
General health (GH)	59.3 (55.1 to 63.5)	6.3 (1.1 to 11.5)*	–0.7 (–7.3 to 5.9)
Physical component summary (PCS)	40.5 (38.3 to 42.7)	3.1 (0.6 to 5.7)*	2.1 (–1.1 to 5.3)
Vitality (VT)	55.5 (51.0 to 60.1)	8.8 (3.0 to 14.5)*	2.9 (–4.3 to 10.1)
Social function (SF)	78.2 (73.2 to 83.3)	6.9 (1.2 to 12.5)*	1.1 (–6.3 to 8.5)
Role emotional (RE)	60.6 (52.5 to 68.8)	15.3 (5.6 to 25.0)*	3.5 (–8.7 to 15.8)
Mental health (MH)	74.0 (70.4 to 77.6)	5.6 (1.0 to 10.2)*	–0.8 (–6.6 to 4.9)
Mental component summary (MCS)	46.7 (44.7 to 48.8)	3.7 (1.1 to 6.2)*	–0.8 (–4.0 to 2.5)

The results are presented as a comparison of the differences between the mean scores.
*p<0.05.

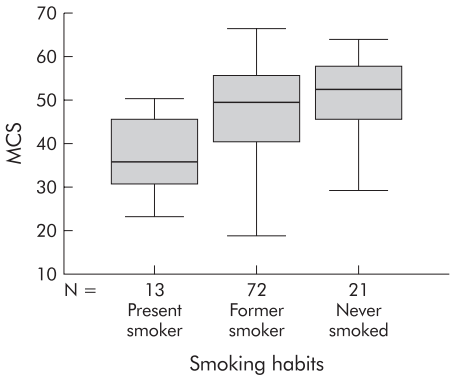

Figure 1 Relation between mental components summary score (MCS) on the SF-36 scale and smoking habits in patients who had undergone lung cancer surgery. Box plots with median and 25th versus 75th percentile and 10th to 90th percentile. Patients still smoking after surgery showed impaired mental health compared with never or former smokers (p<0.05).

instruments have been developed for this purpose, many of which have been standardised in accordance with findings in the normal population.

The incidence of lung cancer is still increasing among women in Sweden, but is not at present increasing among men.[11] There is no sign of a decrease in the frequency of surgery for lung cancer in general.

Little is known about the quality of life in lung cancer patients who have undergone lung resection, possibly because this group of patients generally has poor long term survival and because the cancer is often regarded as incurable. A number of studies of QoL after thoracoscopic procedures for lung cancer have been performed,[12 13] but fewer after open lung cancer surgery.[14 15] Several instruments have been designed to assess the QoL in lung cancer patients, most of which have focused on the effects of adjuvant therapy.[16]

The SF-36 questionnaire allows comparison with healthy controls and has also been evaluated in a substantial number of different diseases. In the present study CABG patients were used as a comparison group. Although CABG patients differ in many respects from lung cancer patients (surgical technique, type of disease, etc), these two patient groups also have much in common—for example, they both suffer from a smoking related disease and have undergone major surgery. Furthermore, CABG patients represent a well documented patient group with regard to QoL.[3 4] The QoL of CABG patients in this study was in agreement with that reported by others.[4]

One of the strengths of the present study is the high response rates—85% in patients with lung cancer and 91% in the CABG group. Moreover, the study can be regarded as population based as all the eligible patients from a well defined geographical area were referred to our clinic. However, possible sources of selection bias constitute a weakness; firstly, the study was restricted to patients considered potentially curable by surgery and, secondly, our results refer to patients who had not died at the time of follow up (after a mean of 23 months the mortality was 32%) and responded to the questionnaire. Patients with lung cancer who did not respond to the questionnaire (15% of the total) are likely to represent a group with impaired QoL. There is therefore a risk that patients who were assessed were selected in the direction of less advanced disease and that the most critically ill patients were not included in the study.

During the first 48 months after surgery the overall QoL of the lung cancer patients, measured with the SF-36, was generally comparable to that of the CABG patients. However, lung cancer patients reported more pronounced limitations in physical function and, in particular, greater breathlessness in connection with effort. Zieren *et al*[14] found more pronounced breathlessness on effort after pneumonectomy than after parenchyma sparing surgery such as lobectomy. In this study patients who underwent pneumonectomy had significantly lower physical summary components and more emotional problems. Decreased lung function is likely to contribute to both these impairments. It has been reported, for example, that respiratory insufficiency in patients with chronic obstructive lung disease is related to impairment of mental health.[17]

Studies of CABG patients have shown improvements in physical function and pain which are already evident 3 months postoperatively,[3] as well as improvements in dimensions of mental health.[4] There were no changes in physical or mental health over time after surgery (4–48 months) among the lung cancer patients in our study. These results may indicate that the postoperative morbidity is minimal as early as 4 months after surgery. In a previous study Dales *et al* found that preoperative activities of daily living were regained 6 months after lung cancer surgery.[15]

No differences were found in the scores for mental health, anxiety and depression between the two groups of patients in our study. Each group deviated significantly from the normal population in SF-36 components reflecting mental health dimension scores.

It is difficult to compare patients with serious illnesses with a healthy population without taking into account the adaptive processes that take place with malignancy, other serious diseases, and disability. The observed significant deviations from the normal population were as expected. Thus, the most important results presented here are the comparisons between the two patient groups.

Patients who smoked after lung cancer surgery experienced impaired QoL compared with non-smokers (both those who

stopped smoking and those who never smoked), with lower scores on the mental summary component (SF-36) and higher scores on the HAD scale indicating impaired mental health. In a recent study[18] it was found that patients with a former history of depression more frequently started smoking again after attempts to stop. Moreover, there are reports of a higher rate of complications and mortality in current smokers than in ex-smokers following lung resection.[19 20] It is difficult to determine whether smoking habits represent a marker of impaired mental health or whether smoking after surgery contributes to increased anxiety and depression. Regardless of the order in the causal chain, programmes to help current smokers stop smoking before or soon after surgery may help to minimise complications[19] and improve both physical and mental health postoperatively. When using such programmes, consideration should be paid to the possibility of a former history of depression or anxiety.[18] Optimised efforts to stop smoking could be made with the assistance of experts using both cognitive-behavioural therapy and psychopharmacological drugs.[21]

Previous comparisons of thoracoscopy with muscle sparing thoracotomy[22] have shown that postoperative pain is overcome 6–12 weeks after surgery, irrespective of the type of operation. This was confirmed in the present study (with the shortest follow up of 4 months) as body pain was the only subclass in which the postoperative patients did not deviate from the normal cohort.

In conclusion, patients who underwent open lung cancer surgery appeared to have a similar QoL to that of CABG patients except for physical function. Both groups of patients deviated from the normal population in all the subclasses of the SF-36 except body pain. Despite the fact that the lung cancer patients had been operated on because of a serious malignancy, their social function and mental health status were not impaired. Furthermore, patients who continued to smoke after surgery seemed to have impaired QoL with regard to mental health compared with those who stopped smoking.

ACKNOWLEDGEMENTS

This study was supported by grants from the Swedish Heart and Lung Foundation and the County of Uppsala Heart and Lung Foundation.

Authors' affiliations
G Myrdal, E Ståhle, Department of Thoracic and Cardiovascular Surgery, Uppsala University Hospital, SE-751 85 Uppsala, Sweden
S Valtysdottir, Department of Medical Sciences, Uppsala University Hospital
M Lambe, Department of Medical Epidemiology, Karolinska Institutet, Stockholm, Sweden

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