Subjective and objective assessment of quality of life after chest wall resection

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Abstract

Objective: To date, quality of life (QoL) after extensive chest wall resection is not known. This study analyses QoL in long-term survivors after extensive resection.

Methods: Retrospective analysis of 51 patients operated for non-small-cell lung cancer (NSCLC)/mediastinal tumour invading the chest wall, primary/secondary chest wall tumours. QoL and functional status of long-term survivors (>36 months) were studied using Borg scale, Mahler dyspnoea index, Functional Autonomy Measuring System (SMAF) and 36-item Short Form Health Survey (SF-36) questionnaire. Out of the 51 patients, pulmonary function tests were available before and after resection in 24 patients and were subjected to analysis.

Results: Five-year survival was 50%, 26 patients survived >36 months. At follow-up, 22/28 deaths were cancer related. Compared to baseline, the reduction of flow expiratory volume in 1 s (FEV1) and forced vital capacity (FVC) were 18% and 15%, respectively (p < 0.001). The QoL study included 23 long-term survivors. A moderate/severe dyspnoea was present in 5/23 patients (21%). The SF-36 questionnaire revealed that, compared to controls, patients with chest wall resection experienced impaired QoL in physical functioning, in role physical, in body pain, in social functioning and in mental health. Objective measurements of pulmonary function correlated poorly with QoL, whereas subjective assessment of dyspnoea was significantly associated with QoL.

Conclusions: This study shows that long-term survivors after extensive chest wall resection experienced moderate impairments in several QoL subscales. As previously reported in patients after pulmonary resection, subjective assessment such as dyspnoea correlated well with patient-perceived QoL.

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Keywords: Chest wall tumour; Quality of life; Survival

1. Introduction

Although long-term survival after chest wall resection has been well studied over the past 20 years [1—3], long-term consequences of extensive surgical treatment for chest wall tumours on patient’s quality of life (QoL) have not been previously reported.

Chest wall resection for both primary and secondary tumours should pursue three objectives: (a) a curative tumour resection with adequate margins, (b) chest wall stability and pulmonary function, resulting in acceptable QoL and, finally, (c) a good cosmetic result.

The concept of QoL was introduced in 1940 by Karnofsky as an index to evaluate the performance status in patients treated with chemotherapy for cancer [4].

More recently, Ferrans and Powers [5] defined QoL as ‘a person’s sense of well-being that stems from satisfaction or dissatisfaction with the areas of life that are important to him/her.’

From earlier studies [6,7], we learnt that the degree of lung resection (pneumonectomy, lobectomy and segmental resection) has been associated with varying degrees of pulmonary and functional status compromise. Additional chest wall resection could potentially worsen pulmonary reserve in such patients.

However, pulmonary function alone is a poor predictor of patients’ perceptions of physical limitations in daily activities [8,9]. Studies have indeed suggested that standard functional pulmonary tests were weakly correlated to a patient’s subjective assessment and that more specific indices should be used [10].
Therefore, a patient’s own assessment of his/her degree of pulmonary impairment and its impact on his/her QoL could provide somewhat different information than those collected through medical assessment [11].

In this study, we analysed 90-day mortality, long-term survival, and focus was placed on QoL (Borg Index, Mahler Basal Dyspnoea Index (BDI), Functional Autonomy Measuring System (SMAF) and QoL questionnaire) as well as pulmonary function evaluation (pulmonary function tests and 6-min walk test) of long-term survivors.

Informed consent was obtained from all study participants. The Committee on Human Rights in Research (Institutional Review Board) of Cliniques Universitaires Saint-Luc gave approval for this study.

2. Materials and methods

2.1. Study cohort (Table 1)

The study cohort was identified through our institutional thoracic surgery database. Our inclusion criteria included any patient who underwent a resection of at least three ribs with/without lung parenchymal resection (wedge resection, lobectomy and pneumonectomy). We also considered as chest wall resection, the resection of an organ participating in the breathing mechanics such as the sternum, the diaphragm and, by analogy, the phrenic nerve.

These procedures involved a multidisciplinary approach in which both thoracic (PN, AP) and plastic (BL) surgeons were acting complementarily. All patients underwent a primary closure, with/without a chest wall prosthetic substitute (Marlex; C.R. Bard Inc., Cranston, NJ, USA or Gore Tex dualmesh, WL Gore and Associates, Flagstaff, AZ, USA), and with/without muscular or omental flaps. Skin grafting was used in selected patients. Gore Tex dualmesh was primarily used for diaphragm repair or replacement.

From 1988 to 2003, 51 patients underwent 67 chest wall resections. There were 29 male (57%) and 22 female (43%) patients. Patient characteristics and indications for surgery are summarised in Table 1.

The median tumour size was 9 cm (3–35 cm) and the median number of resected ribs was 3 (0–6). Additional lung resection was performed in 34 patients (67%). Forty-eight patients (94%) underwent multiple ribs and/or sternum resection (38 rib resections, two sternum resections and eight ribs/sternums resections). In addition, among the 51 patients, 11 patients, who were subjected to phrenic nerve resection, benefited from concomitant ipsilateral diaphragm plication.

Among the vascularised flaps (n = 25), we transferred the latissimus dorsi (n = 9), the greater omentum (n = 6), the major pectoralis (n = 4), the rectus abdominis and the serratus (n = 3 for each). In two patients, an autologous fascia lata was used to repair the defect.

2.2. Follow-up

Information was collected from patient operative reports, hospitalisation charts and our thoracic database. Follow-up was completed from October 2005 up to May 2006 and was done through contacts with the referring oncologist or pulmonary physician, the primary care physician and the patients themselves. No patient was lost to follow-up. Among long-term survivors, follow-up and complete subjective assessment (QoL) was 90% complete (23/26 patients).

2.3. Patient assessment

2.3.1. Objective measurements

2.3.1.1. Pulmonary function tests. Measurements were performed using a Morgan TLC spirometer (Morgan Medical, Rainham, UK; software: Mdas 4.01, 1999) with determination of flow expiratory volume in 1 s (FEV1), forced vital capacity (FVC) and calculation of the FEV1/FVC ratio. All measures were obtained at baseline preoperatively and during follow-up visits more than 1 year after the operation. For comparison, we used the reference values from the European Respiratory Society [12].

Personal performing spirometry technicians were trained, supervised and monitored by one of the co-investigators (GL, Director of the Cliniques Universitaires Saint-Luc Pulmonary Function Laboratory) and spirometry records were reviewed for quality assessment.

In general, 17/23 long-term survivors who responded to the QoL questionnaires had pre- and postoperative evaluation. The mean time from resection to postoperative pulmonary tests was 31 months (range: 4–82).

2.3.1.2. 6-min walk test. Eleven out of the 26 long-term survivors accepted to be submitted to a 6-min walking test (WT) and their performance was compared to a predictive value (adjusted for age, sex and weight) to estimate their

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Table 1

<table>
<thead>
<tr>
<th>Patients characteristics (n = 51).</th>
<th>n (%) of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>53.9</td>
</tr>
<tr>
<td>Sex (male/female)</td>
<td>29/22</td>
</tr>
<tr>
<td>Type tumour</td>
<td></td>
</tr>
<tr>
<td>Primary chest wall</td>
<td>8/16</td>
</tr>
<tr>
<td>Secondary chest wall</td>
<td>24/47</td>
</tr>
<tr>
<td>NSCLC</td>
<td>13/25</td>
</tr>
<tr>
<td>Mediastinal tumors</td>
<td>6/12</td>
</tr>
<tr>
<td>Type of pulmonary resection</td>
<td></td>
</tr>
<tr>
<td>None/wedge/segmentectomy</td>
<td>30/59</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>17/33</td>
</tr>
<tr>
<td>Pneumonectomy</td>
<td>4/8</td>
</tr>
<tr>
<td>Chest wall resection</td>
<td></td>
</tr>
<tr>
<td>Ribs</td>
<td>46/90</td>
</tr>
<tr>
<td>Sternum</td>
<td>10/20</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>4/8</td>
</tr>
<tr>
<td>Reconstruction</td>
<td></td>
</tr>
<tr>
<td>Prosthetic and autologous flaps</td>
<td>19/37</td>
</tr>
<tr>
<td>Prosthetic alone</td>
<td>14/27</td>
</tr>
<tr>
<td>Autologous alone</td>
<td>4/8</td>
</tr>
<tr>
<td>Primary closure</td>
<td>14/27</td>
</tr>
</tbody>
</table>

* 24 patients with both preoperative and postoperative PFTs available for analysis.
objective capacities compared with their own subjective assessment. To be considered as normal, the patient's walking distance during the 6-min WT had to be at least 70% of his predicted distance.

2.3.2. Subjective measurements

First, we recorded the World Health Organization (WHO) performance status score.

For the evaluation of dyspnoea, both the Borg scale [13] and the BDI of Mahler [14] were selected. In the Borg scale, the subjects were asked to quantify the sensation of breathlessness in their daily life by pointing to a score on a large visual scale from 0 (none) to 10 (maximal). This score has been shown to be applicable to any cardio-pulmonary patient to describe dyspnoea [15].

The Mahler BDI is a multidimensional grading of dyspnoea, using the categories of 'functional impairment', 'magnitude of task', and 'magnitude of effort' on a scale of 0—4, where 4 represents best and 0 represents worst.

For autonomy assessment, we used the Functional Autonomy Measurement System (Système de Mesure de l’Autonomie Fonctionnelle (SMAF)). In brief, this autonomy evaluation instrument was developed based on the theoretical framework of WHO’s international classification of impairments, disabilities and handicaps. It evaluates 29 functions covering activities of daily living (seven items), mobility (six items), communication (three items), mental functions (five items) and instrumental activities of daily living (eight items). Each function is scored on a five-point scale (0, −0.5, −1, −2, and −3). Inter-rater and test—retest reliability and validity of the SMAF have been demonstrated [16]. This instrument has been translated into seven languages and is used in many epidemiological studies [16]. A high score on this scale indicates a low level of functional autonomy and a change of five points or more from the previous value (when longitudinal data are available) should be considered clinically significant [17].

As for QOL assessment, we selected the Medical Outcomes Study 36-item short form (SF-36) [18].

It comprises 36 items, grouped into eight scales, which include both physical and mental health and assess eight dimensions of QoL. The raw scale 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 score (PCS) and the mental component summary score (MCS). The PCS includes physical functioning (PF), role physical (RP), body pain (BP) and general health (GH) subscales, whereas MCS includes energy/vitality (E) social functioning (SF), role emotional (RE) and mental health (MH).

Finally, we correlated the QoL and the pulmonary function after the resection, by comparing subjective parameters (QoL) and objective data (pulmonary function tests).

Similarly, 50 patients, who were operated for thoracic malignancies between 2003 and 2006, completed the QoL questionnaires on the day prior to surgery and served as the control group. We selected this group as adequate controls since both study and control groups shared in common a diagnosis of malignant disease.

2.4. Statistics

Survival was calculated from the date of the first surgery to the end point (90-day mortality), or to the date of latest follow-up (long-term mortality) or death.

Disease-free survival was studied and defined as the interval between the first operation and the date of the diagnosis of the first recurrence. Survival percentages were computed by the Kaplan—Meier method. Univariate regression of survival data was done by the maximum likelihood method with the Cox proportional-hazards model.

Oncologic and functional predictor variables included in the survival analysis included completeness of the resection, the number of ribs resected, tumour pathology, tumour size (<5 or >5 cm), the presence of additional lung resection, pre- and postoperative pulmonary function tests (FVC greater or less than 70%, and postoperative FEV1 greater or less than 65%, respectively).

Parameters selected for subjective measurements were considered to be normally distributed. The raw scores in the SF-36 scale were calculated for the 22 responding patients and converted to a 0—100 scale using the formula specified in the scoring manual for SF-36 [19].

Descriptive statistics are presented as means unless otherwise indicated. Intra- and inter-group differences were analysed using the unpaired Student’s t-test (two-tailed).

A linear regression model was used to test correlations between clinical and/or objective parameters and subjective assessment.

All the statistical analyses were performed using a statistical software package (SPSS version 14.0). Differences were considered significant when the p value was less than 0.05.

3. Results

3.1. 90-day mortality

Two patients died during the postoperative period (3.9%): the first patient, a 36-year-old female with a recurrent breast carcinoma, died from pulmonary infection complicated by septic shock. Another patient died of respiratory failure on day 56 because of a broncho-pleural fistula after an ‘extended’ right pneumonectomy (six-rib chest wall/diaphragm resection) for metastatic sarcoma. There was no other 90-day death.

3.2. Survival

The overall 3- and 5-year survival rates were 53% and 50.4%, respectively.

Figs. 1 and 2 show the influence of different variables on overall survival (OS).

Among cancer-related variables, only the completeness of the resection was significantly correlated with survival (p = 0.04). Five-year OS for R0 (41/51 patients, or 80%) and R1 resection were 55.5% and 30%, respectively. Patients with resection of three ribs or more had a lower 5-year OS but this difference was not statistically significant (47% vs 52%; p = NS).
Concerning the type of tumour, the 5-year OS was highest for primary chest wall tumour (75%) than for patients with T3 non-small-cell lung carcinoma (69%) and mediastinal tumours (55%) and was the lowest for patients with secondary chest wall tumour (29.2%). Probably due to low numbers, this intergroup difference was only of borderline significance ($p = 0.056$) (Fig. 1). By completion of follow-up, 28 patients had died. Causes of death were mostly cancer-related (22/28 (78%). For the entire group, the median disease-free survival was 60 months (95% CI (44—76 months)).

Among pulmonary function-related variables, survival was decreased in patients with impaired pulmonary function preoperatively (FEV1 < 70% predicted) and significantly decreased ($p = 0.036$) for those with impaired postoperative pulmonary function (poFEV1 < 65% predicted) (Fig. 2). By univariate analysis, we found that patients with impaired pulmonary function (with a postoperative FEV1 less than 65% of predicted) had a 3.8-fold greater likelihood of death compared with patients with postoperative FEV1 equal or greater than 65% (hazard ratio (HR) for death = 3.8 (95% CI (1—15))).

### Objective functional assessment

Pre- and long-term postoperative pulmonary function tests (PFTs) were available in 24 patients out of the 51 initial cohort.

The mean reduction ($\pm SD$) of FEV1 was $-15.2 \pm 14.7\%$ and the mean reduction of FVC was $-14 \pm 14.4\%$. Both parameters were significantly decreased compared with preoperative values ($p < 0.001$ for each). Interestingly, the mean reduction ($\pm SD$) of both FEV1 and FVC in the subgroup of patients, who had associated major parenchymal resection (lobectomy/ pneumonectomy) ($N = 10$), were $-18.6\%$ and $-17.7\%$, respectively, and this reduction was not significantly different from the reduction in the subgroup who had chest wall resection $\pm$ minor lung resection (wedge) ($N = 14$), $-13.1\%$ and $-12.2\%$, respectively.

A postoperative 6-min WT was obtained in 11 patients only. The mean walking distance was 63.5% of the predicted value (range: 39—88%) (data not shown). Importantly, when adjusted for age, sex, height and weight, six patients (55%) walked a distance lesser than 70% of the predicted distance whereas only two patients (18%) reported a score greater than 2 on the Borg dyspnoea scale.

### Subjective assessment

#### WHO performance score (ECOG)

The mean Eastern Cooperative Oncology Group (ECOG) score for the 23 patients, who completed the study, was 0.83 (SD 1.2). Seven patients (30%) had an ECOG score $\geq 2$. Minimal or no symptoms was present in 14 patients (61%) (Table 2).

#### Borg dyspnoea index and Mahler BDI

Fig. 3(a) and (b) show histograms of both Borg and Mahler’s scores illustrating a skewed distribution toward the asymptomatic side by both scaling systems.

For the entire group, the mean Borg dyspnoea index was 1.4 and the mean BDI was 9.1, reflecting minor subjective symptoms at rest and for daily life activities.

#### SMAF score

The mean SMAF disability score for the entire group was $-10.5$ points (SD 5.9), which represents a 12% ($\pm 6.8\%$) reduction in patient functional autonomy (Table 3). Using the median age (56 years) as a cutoff, we could not demonstrate

Table 2

<table>
<thead>
<tr>
<th>QOL outcomes in chest wall resection patients.</th>
<th>Total sample $(n = 23^*)$ Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECOG score</td>
<td>0.83 (1.2)</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>1.4 (2)</td>
</tr>
<tr>
<td>Borg scale</td>
<td>9.1 (3)</td>
</tr>
<tr>
<td>Mahler DBI</td>
<td>10.5 (5.9)</td>
</tr>
<tr>
<td>Functional autonomy reduction in SMAF ($/87$ points)</td>
<td>56 (12)</td>
</tr>
<tr>
<td>SF-36 subscales</td>
<td></td>
</tr>
<tr>
<td>Physical functioning</td>
<td>62 (10)</td>
</tr>
<tr>
<td>Role limits-physical</td>
<td>56 (12)</td>
</tr>
<tr>
<td>Body pain</td>
<td>66 (7)</td>
</tr>
<tr>
<td>General health</td>
<td>56 (10)</td>
</tr>
<tr>
<td>Energy/vitality</td>
<td>58 (7)</td>
</tr>
<tr>
<td>Social functioning</td>
<td>70 (7)</td>
</tr>
<tr>
<td>Role limits-emotional</td>
<td>58 (8)</td>
</tr>
<tr>
<td>Mental health</td>
<td>70 (7)</td>
</tr>
</tbody>
</table>

* One patient did not answer the SF-36 form.
a significant reduction in the functional autonomy among older patients (10.9 ± 5.1 vs 10 ± 6.9; p = NS). Patients with preoperative low pulmonary reserve (FEV₁ < 70%) experienced significantly less reduction in their functional autonomy as compared with group of patients with normal pulmonary function (1.2 ± 1.8 vs 12.4 ± 5.7; p = 0.02). However, when we compared the SMAF disability scores among groups according to the postoperative pulmonary reserve (FEV₁ < 65%), no significant difference was noticed (12.6 ± 8.1 vs 11 ± 5.7; p = 0.67). Finally, patients who underwent chest wall together with major pulmonary resection had a significantly greater reduction in their functional autonomy as compared with group of patients with chest wall resection with/without additional minor (wedge) lung resection (14.9 ± 4.9 vs 7.9 ± 4.9; p = 0.004).

3.4.4. SF-36 questionnaire

Fig. 4 illustrates the postoperative scores of patients with chest wall tumours who underwent resection compared with age- and sex-matched subjects with a diagnosis of thoracic malignancy who completed the QoL questionnaires on the day prior to surgical resection. In comparison to those controls, after chest wall resection, significant impairment was noted in PF (p < 0.001), RP (p = 0.04), BP (p < 0.001), SF (p = 0.01) and in MH (p < 0.001). Interestingly, general health, energy and role emotional were not different from unoperated subjects.

In addition, both PCS and MCS were compared between study and control patients. As expected, the mean PCS of the chest wall resection group was lower than the control subjects group (39.8 ± 1.6 vs 41.6 ± 12.9) but this difference was not significant (p = 0.34), and similar findings were present when MCS was analysed (44.1 ± 1.8 vs 41.8 ± 10.7; p = 0.15).

Table 3 summarises the various subjective assessment tests used in the study group according to objective parameters (variables selected were age, preoperative and postoperative pulmonary function and associated major parenchymal resection). As stated earlier in Section 2, pre- and postoperative PFTs were available in 17 out of the 22 QOL SF-36 form responders (77.3%).

With the exception of the mental component from the SF-36 questionnaire, no association was found between objective parameters and any of the scores addressing patient assessment of QoL. Of note, patients with low preoperative pulmonary reserve had a significantly decreased MCS score after surgery.

We then divided our study group according to the presence (n = 8) or absence (n = 15) of associated major lung resection. With respect to the PCS, both subgroups were not significantly lower than the control subjects (39.6 and 39.9 vs 41.6; p > 0.05), whereas for the MCS, patients without associated major lung resection had higher scores of borderline significance (44.6 vs 41.8; p = 0.08). The mean MCS for patient with associated lung resection was 43.1 (p = 0.44).

Table 3
QoL scores by prognostic indicators (n = 23).

<table>
<thead>
<tr>
<th>WHO/ECOG</th>
<th>Borg scale</th>
<th>Mahler BDI scale</th>
<th>SMAF reduction (in %)</th>
<th>SF-36 PCS</th>
<th>SF-36 MCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤56 yo (n = 11)</td>
<td>0.7</td>
<td>1.2</td>
<td>10.1</td>
<td>10</td>
<td>40.3</td>
</tr>
<tr>
<td>&gt;56 yo (n = 12)</td>
<td>0.9</td>
<td>1.6</td>
<td>8.2</td>
<td>10.9</td>
<td>39.4</td>
</tr>
<tr>
<td>Pre-op FEV₁a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;70% predicted (n = 3)</td>
<td>0.7</td>
<td>0.7</td>
<td>10.7</td>
<td>12.4</td>
<td>41.7</td>
</tr>
<tr>
<td>≤70% predicted (n = 14)</td>
<td>0.9</td>
<td>1.5</td>
<td>8.9</td>
<td>1.2¹</td>
<td>39.6</td>
</tr>
<tr>
<td>Post-op FVC¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;65% predicted (n = 6)</td>
<td>0.4</td>
<td>1</td>
<td>10</td>
<td>11</td>
<td>40.6</td>
</tr>
<tr>
<td>≤65% predicted (n = 11)</td>
<td>1.2</td>
<td>1.6</td>
<td>8.5</td>
<td>12.6</td>
<td>39.5</td>
</tr>
<tr>
<td>Associated lung resection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None/wedge (n = 15)</td>
<td>0.7</td>
<td>1.2</td>
<td>9.3</td>
<td>7.9</td>
<td>39.7</td>
</tr>
<tr>
<td>Lob/pneumonectomy (n = 8)</td>
<td>1</td>
<td>1.5</td>
<td>9</td>
<td>14.9¹</td>
<td>39.9</td>
</tr>
</tbody>
</table>

¹ Complete preoperative and postoperative pulmonary function tests were available in 17 out of the 23 responders to QOL questionnaires.
² p < 0.05.
Finally, we investigated whether subjective assessment of dyspnoea (a Borg score of 3 or greater, or a Mahler BDI score of less than 8) would be associated with decreased QoL.

As shown in Fig. 5(a) and (b), both dyspnoea scales were closely related to patient-perceived QoL, with the strongest correlation found between the PCS and the Mahler BDI scale ($R^2 = 0.747$).

### 4. Discussion

Analysis of survival in patients undergoing major chest wall resection for both primary/metastatic chest wall tumours and primary non-small-cell lung cancer (NSCLC) underscores once more that the key prognostic factor for long-term survival is complete pathological resection.

Eighty percent of our patients had a complete resection and upon complete resection, overall 5-year survival was 85% for primary CWT, 50% for NSCLC invading the chest wall and 38% for secondary CWT.

Previous studies have shown for both lung cancer surgery and major chest wall surgery that pulmonary function is an independent predictor of survival [20,21]. Similarly, our survival analysis after chest wall resection showed an increased risk of death in patient with impaired pulmonary function, and was conditional to reduced postoperative FEV1.

This highlights the need to assess as accurately as possible the functional consequences of the resection and to individualise repair strategy based on patient pulmonary status.

In the long-term survivors of our series, we only had a 15% reduction in FEV1 postoperatively, with no significant difference whether or not associated lung resection was performed. Though no clear explanation is available, it is possible that our nearly systematic use (73%) of parietal substitute (either autologous and/or alloplastic material) to cover the chest wall defect might have contributed to these results.

Subjective assessment of dyspnoea and its impact on patient QoL has been shown to vary among subgroups studied. Indeed, for the same degree of dyspnoea, surviving patients with a diagnosis of lung cancer were shown to have better QoL than those with a diagnosis of chronic obstructive pulmonary disease (COPD) [22]. This remained true for our population of patients with chest wall tumours, independently of the aetiology. Even though there was a significant reduction in functional capacity after surgery (both FEV1 and FVC), the subgroup of patients who completed our survey displayed only minor subjective impairment, as reflected by a low mean Borg dyspnoea score as well as a high Mahler BDI.

Our limited number of patients who completed the 6-min WT does not allow us to draw strong conclusions, but findings were in line with other studies [23], namely that when exercise capacity testing is used as an objective parameter to assess QoL, it fails to accurately discriminate those patients with or without subjective complaints.

In our study, only five patients (45%) had an exercise capacity greater than 70% of its expected value.

Both SMAF disability and SF-36 questionnaires were used in this study and both led to similar conclusion: in such patients, functional autonomy was not severely affected in the long term. As for the SMAF, the mean disability score after resection was $-10.5$, which could be seen as clinically relevant if we hypothesised that none of the patients suffered any disability before resection [24]. Unfortunately, the lack of preoperative SMAF evaluation in those patients greatly hampered the conclusion on the precise impact of the resection on patient’s functional autonomy. The SF-36 questionnaire allowed a more detailed analysis since data for age- and sex-matched controls were available. Our analysis revealed that impairments were present in PF, RP, BP, SF and in MH and, to a lesser degree, in RE, whereas other areas of analysis such as GH and E were not affected. Expectedly after such surgery, the 14 questions related to daily life physical activities demonstrated that long-term survivors experienced some limitations and had to self-adapt.

In general, patients reported ‘bodily pain’ being present over the 4-week period preceding the questionnaire’s completion and it moderately interfered with their daily life. Unfortunately, the ‘body pain’ subscale in the SF-36 questionnaire does not specifically address the question of chest wall pain control so that this study does not provide insights on this important issue.

Finally, when subscale components were aggregated in the two summary scores, which reflect more broadly the physical and the mental health status of those patients, respectively, the measured differences compared with unoperated patients having a diagnosis of malignancy were rather small.

Our finding that PCS was significantly correlated to patient’s dyspnoea corroborates previous studies performed on patients with lung cancer or COPD, which had shown the absence of correlation between objective assessment of pulmonary function and patients’ QoL, whereas a strong correlation was present between QoL and the subjective assessment of pulmonary function, that is the presence/absence of dyspnoea [6,25].

There were some limitations in this study, which should not be overlooked: first, QoL assessment was not analysed preoperatively, and because of its retrospective design, less than half of the patients (survivors) were included in QoL and functional evaluation, which might have introduced a selection bias. Second, the heterogeneity of the groups in terms of diagnosis and of resection should prompt us to interpret the results with caution.

Finally, several patients underwent pre- and/or post-operative chemotherapy and/or radiation therapy and our study did not include such variables in the postoperative lung
function and QoL analysis. Some of those treatment modalities could have influenced our results.

In conclusion, this study shows that long-term survivors after extensive chest wall resection experienced moderate impairment in several QoL subscales. However, when compared with unoperated patients with a diagnosis of thoracic malignancy, their overall QoL is acceptable. This study also underscores the importance preoperatively in planning the amount of resection as well as the type of reconstruction to offer, as leaving patients off with severe pulmonary impairment will greatly undermine their long-term survival.

References