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Quality of life after pulmonary embolism as assessed with SF-36 and PEmb-QoL

Josien van Es [a,*,1], Paul L. den Exter [b,1], Ad A. Kaptein [c], Cornelie D. Andela [d], Petra M.G. Erkens [e], Frederikus A. Klok [b], Renee A. Douma [a], Inge C.M. Mos [b], Danny M.Cohn [a], Pieter W. Kamphuisen [f], Menno V. Huisman [b], Saskia Middeldorp [a]

[a] Department of Vascular Medicine, Academic Medical Centre, Amsterdam, the Netherlands
[b] Department of Thrombosis and Haemostasis, Leiden University Medical Centre, Leiden, the Netherlands
[c] Section Medical Psychology, Leiden University Medical Centre, Leiden, the Netherlands
[d] Department of Endocrinology and Metabolic diseases, Leiden University Medical Center, the Netherlands
[e] Department of Clinical Epidemiology, School for Public Health and Primary Care (CAPHRI), Maastricht University Medical Center, the Netherlands
[f] Department of Vascular Medicine, University of Groningen, University Medical Center Groningen, Groningen, the Netherlands

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ABSTRACT

Introduction: Although quality of life (QoL) is recognized as an important indicator of the course of a disease, it has rarely been addressed in studies evaluating the outcome of care for patients with pulmonary embolism (PE). This study primarily aimed to evaluate the QoL of patients with acute PE in comparison to population norms and to patients with other cardiopulmonary diseases, using a generic QoL questionnaire. Secondary, the impact of time period from diagnosis and clinical patient characteristics on QoL was assessed, using a disease-specific questionnaire.

Methods: QoL was assessed in 109 consecutive out-patients with a history of objectively confirmed acute PE (mean age 60.4 ± 15.0 years, 56 females), using the generic Short Form-36 (SF-36) and the disease specific Pulmonary Embolism Quality of Life questionnaire (PEmb-QoL). The score of the SF-36 were compared with scores of the general Dutch population and reference populations with chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), a history of acute myocardial infarction (AMI), derived from the literature. Scores on the SF-35 and PEmb-QoL were used to evaluate QoL in the short-term and long-term clinical course of patients with acute PE. In addition, we examined correlations between PEmb-QoL scores and clinical patient characteristics.

Results: Compared to scores of the general Dutch population, scores of PE patients were worse on several subscales of the SF-36 (social functioning, role emotional, general health ($P < 0.001$), role physical and vitality ($P < 0.05$)). Compared to patients with COPD and CHF, patients with PE scored higher (=better) on all subscales of the SF-36 ($P \leq 0.004$) and had scores comparable with patients with AMI the previous year. Comparing intermediately assessed QoL with QoL assessed in long-term follow-up, PE patients scored worse on SF-36 subscales: physical functioning, social functioning, vitality ($P < 0.05$), and on the PEmb-QoL subscales: emotional complaints and limitations in ADL ($P \leq 0.03$). Clinical characteristics did not correlate with QoL as measured by PEmb-QoL.

Conclusion: Our study demonstrated an impaired QoL in patients after treatment of PE. The results of this study provided more knowledge about QoL in patients treated for PE.

Introduction

Quality of life (QoL), defined as patients' reported impact of disease and treatment on his/her physical, psychological and social functioning and wellbeing, has been demonstrated to be associated with clinical endpoints and is considered as an important outcome measure in clinical research [1–3]. QoL can be assessed by generic QoL instruments scoring standardized responses to standardized questions (e.g. the Short Form 36 (SF-36)). These generic instruments are designed to sample a broad spectrum of function, disability, and

Abbreviations: ADL, activities of daily living; AMI, acute myocardial infarction; BMI, body mass index; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CTEPH, chronic thromboembolic pulmonary hypertension; IQR, interquartile range; LMWH, low molecular weight heparin; PE, pulmonary embolism; PEmb-QoL, Pulmonary Embolism Quality of Life; QoL, quality of life; SD, standard deviation; SE, standard error; SF-36, Short Form-36; VTE, venous thromboembolism.

* Corresponding author at: Department of Vascular Medicine, Academic Medical Center F4-143, Meibergdreef 9, 1105 AZ Amsterdam, The Netherlands. Tel.: +31 20 5668274; fax: +31 20 5669343.
E-mail address: j.vanes@amc.uva.nl (J. van Es).

[1] Contributed equally.

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distress that is relevant to QoL. In doing so, generic instruments are applicable to a wide variety of populations, irrespective of the illness or condition of the patients, and allow comparison between different patient groups. QoL can also be assessed by disease-specific QoL questionnaires, which assess disease-specific elements of QoL and have been shown to be sensitive in detecting and quantifying changes in QoL that might be relevant to patients with a specific disease [2–5]. Considering the difference in perspective between generic and disease-specific questionnaires, several QoL studies combine generic and disease-specific instruments [6,7]. Although it is known that both the acute event itself, as well as the long-term clinical course of acute pulmonary embolism (PE) is frequently complicated by serious adverse events, such as recurrent venous thromboembolism (VTE) or chronic thromboembolic pulmonary hypertension (CTEPH) [8], there is a lack of knowledge on how this translates into QoL.

Recently, a disease-specific instrument for assessing QoL after PE, called the Pulmonary Embolism Quality of Life (PEmb-QoL), has been developed and validated. The PEmb-QoL assesses pulmonary signs and symptoms in addition to limitations in daily activities, and emotional and social complaints [9,10]. Given that recent data indicate that PE is frequently associated with serious long-term clinical consequences, it would be important to know to what extent QoL of patients after acute PE compares to QoL of patients with *chronic* (cardio-) pulmonary diseases, such as chronic obstructive pulmonary disease (COPD) and congestive heart failure (CHF) and to patients with *acute* cardiopulmonary disease such as a history of acute myocardial infarction (AMI) the previous year [11]. Yet, such a comparison has not been performed. The primary objective of this study was to compare QoL as expressed by SF-36 scores in patients with acute PE with general population norms, and to patients with COPD, CHF and in the first year after AMI. The secondary objectives were to evaluate QoL in the short-term and long-term clinical course of patients with acute PE, as expressed the disease specific PEmb-QoL, and to investigate whether patients' characteristics impacted their QoL, as measured with the PEmb-QoL.

Methods

Patients

The SF-36 and the PEmb-QoL questionnaire were distributed by post between August 2011 and January 2012, among a consecutive sample of 150 patients with first or recurrent PE between October 2008 and December 2011 in the Academic Medical Center, Amsterdam, Maastricht University Medical Center, and Leiden University Medical Center, the Netherlands. Patients filled out the questionnaires at home and returned them by regular mail. A total of 109 (73%) completed the questionnaire after a median of 25 months, range 5-46 months. A quarter of the patients filled out the questionnaire within the first 15 months after diagnosis of PE. All patients with objectively proven PE by a CT-scan or high probability ventilation perfusion scintigraphy, who were hemodynamically stable and aged above 18 years, were eligible. The only exclusion criterion was impossibility to follow-up. All surviving patients had been contacted by telephone every 6 months from the time of diagnosis of PE to assess the PE recurrence and CTEPH rate, as part of an ongoing observational, prospective follow-up study, which aims to evaluate the natural clinical course of patients with PE.

PE was classified in two levels of thrombus occlusion, i.e. central (including central, interlobar vessels) or peripheral (including lobar, segmental and subsegmental vessels) using a scoring system according to Qanadli et al. [17]. Briefly, this index is defined as the number of segmental artery branches that are blocked, corrected by a factor of one for partial blockage, or a factor of 2 for complete obstructive clots. Using this scoring system, 40 is the highest possible score (thrombus completely obstructing the pulmonary trunk), corresponding with a 100% obstruction index.

Patients were treated with vitamin K antagonists, with a target International Normalized Ratio (INR) between 2.0 and 3.0, for at least 6 months [12]. Low molecular weight heparin (LMWH) was given until the INR was above the lower target range on 2 consecutive occasions, with a minimum of 5 days. Patients with active malignant disease were treated with LMWH during the first 6 months of anticoagulant treatment [13]. Demographic data and additional relevant information were collected on a Case Record Form.

The SF-36 and PEmb-QoL questionnaire were applied in Dutch and results of the questionnaires were entered manually into a database.

QoL Questionnaires

The SF-36 comprises 36 items and assesses general well-being during the previous 30 days. It contains eight subscales: physical functioning, social functioning, physical role functioning, emotional role functioning, mental health, vitality, bodily pain and general health. Scores are expressed on a 0–100 scale, with higher values indicating better general well-being [14].

The PEmb-QoL [10] comprises 38 items and assesses disease-specific QoL during the previous 4 weeks and includes 6 subscales: frequency of complaints, activity of daily life (ADL) limitations, work-related problems, social limitations, intensity of complaints, and emotional complaints. The minimum score for all subscales was 1 (indicating no complaints) and the maximum scores were respectively 5, 3, 2, 5, 6 and 6 (indicating worse outcome).

Reference Populations

The SF-36 has been administered to a representative sample of the general Dutch population to validate the Dutch version of the SF-36 in the Netherlands [15]. We compared QoL reflected in SF-36 scores in patients treated for PE with general population norms, and with SF-36 scores of patients with COPD, CHF and AMI within one year prior to enrolment, derived from the literature [11,16]. For this analysis, we excluded patients in our cohort with a history of COPD, CHF and a history of AMI one year prior to exclusion in order to compare these chronic cardio-pulmonary diseases with patients with PE only.

For the disease comparison groups, published data of SF-36 outcomes of patients with advanced chronic obstructive pulmonary disease (COPD) (Global Initiative for Chronic Obstructive Lung Disease stage III or IV) [16], severe chronic heart failure (CHF) (New York Heart Association class III or IV) [16], and with a history of AMI < 12 months prior to inclusion were used [11]. Patients with COPD and CHF were included in 6 hospitals in the Netherlands in 2008 and 2009 [16] and data of patients with AMI the previous year were assessed from the Medical Outcomes Study (MOS), a survey of 22,462 patients, between the ages of 18 and 97, seen in the practices of 523 physicians in the USA [11].

Outcome Measures

Primary outcome measures were SF-36 scores of the patients with PE. These scores were compared with Dutch population norms and with patients with other cardiopulmonary diseases: COPD, CHF and the first year after AMI. Our secondary outcome was QoL, as measured by the PEmb-QoL, after both intermediate and long-term follow-up in patients with a history of acute PE. We arbitrarily denoted follow-up as intermediate if the time frame between the diagnosis of PE and filling out of the questionnaire was shorter than 15 months (which was the 25th percentile in this cohort), and long-term when the time frame was longer. We analyzed the responses to the questionnaires first in the total cohort and second in two groups of participants, divided by the 25th quartile of the timespan between diagnosis of

PE and filling out the questionnaire. In addition, we investigated the impact of the following a priori defined clinical determinants on QoL as measured with the PEmb-QoL questionnaire: age, body mass index (BMI), active malignancy, COPD, CHF, history of venous thromboembolism, smoking habits, time frame between diagnosis and inclusion, Qanadli score and centrally located PE. Active malignancy was defined as cancer with ongoing treatment, treatment within the last 6 months, or in a palliative stage.

Statistical Analyses

Normally distributed variables are presented as mean and standard deviation (SD), non-normally distributed variables are expressed as medians with ranges.

The scores for the SF-36 dimensions in our patient sample were compared to the published means and SDs for each scale among the general population and the reference populations, using the standard deviate (z-score). To adjust for age differences between patients and control subjects of the general Dutch population, the population norms were weighed with the age distribution of our sample.

Because the time frame between PE and assessment of SF-36 and PEmb-QoL ranged between 5 and 46 months, partial bivariate correlations -controlling for the time between PE and filling out questionnaires- were calculated between factors potentially influencing the QoL such as BMI, COPD, CHF, history of VTE, recurrent PE and malignancy and the different scales of the questionnaires. For non-normally distributed data, we used the Spearman rank correlation test.

The scores for the SF-36 dimensions and the reference data, reported in the present study were compared to the published means and SDs for each scale among the general population and the reference populations, using the standard deviate (z-score).

P-values < 0.05 were considered statistically significant. The calculations of the scores of the SF-36 and PEmb-QoL questionnaire and all other analyses were conducted using statistical software SPSS, version 19.0; (SPSS Inc; Chicago, IL). In case of missing data, we excluded that specific scale in total from further analyses. The residual scales, however, were interpreted.

Results

Patients

The clinical characteristics at baseline of the participants are depicted in Table 1. Mean age was 60 4 ± 15.0 years and 51% of the participants were female. The median time span between PE and completing the questionnaires was 25 months (IQR 15-31). In the time between PE and the questionnaire, 6 patients experienced a recurrent VTE, of which all cases were PE, and 1 patient developed CTEPH.

Table 1
Baseline characteristics of patients with clinically pulmonary embolism.

Characteristics	Value N = 109
Female, n (%)	56 (51)
Age in years, mean (SD)	60.4 (15.0)
COPD, n (%)	8 (7)
CHF, n (%)	3 (3)
AMI one year prior to enrollment	0 (0)
History of PE, n (%)	9 (8)
History of DVT, n (%)	10 (9)
Active malignancy, n (%)	21 (19)
Current smoker, n (%)	18 (17)
Centrally located PE, n (%)	16 (15)
Anticoagulant therapy > 6 months, n (%)	28 (26)
Anticoagulant therapy at time of questionnaire completion, n (%)	17 (16)
Qanadli score (0-40), median (range)	7 (0-29)
Time span in months between PE and study inclusions, median (IQR)	25 (15-31)

AMI acute myocardial infarction; CHF congestive heart failure, COPD chronic obstructive pulmonary disease, DVT deep venous thrombosis; IQR interquartile range, N number, SD standard deviation, PE pulmonary embolism, VTE venous thromboembolism.

QoL as Measured by the SF-36 in Patients Treated for PE Compared to the Dutch General Population

The number of patients was, per complete SF-36 scale: 105 for physical functioning, 102 for social functioning, 102 for physical role functioning, 100 for emotional role functioning, 105 for mental health, 103 for vitality, 102 for bodily pain and 99 for general health.

After excluding the patients with COPD, CHF or AMI the previous year in our cohort, 98 patients with PE only remained for this analysis. We compared patients with PE to the general Dutch population subjects ($n = 140$), which were population-based groups of non-institutionalized individuals with a mean age of 59 years in the Netherlands [17]. Patients with PE had markedly lower scores than the general population on the subscales: social functioning (79.3 vs. 86.6), role emotional (79.6 vs. 90.1), general health (55.4 vs. 64.4) ($p < 0.001$), and on the role physical (64.5 vs. 76.5) and vitality (62.7 vs. 67.0) ($p < 0.05$). On the subscales physical functioning, mental health and pain no differences were observed ($p = 0.40$, $p = 0.96$ and $p = 0.12$ respectively) (Table 2 and Fig. 1).

QoL as Measured by the SF-36 in Patients Treated for PE Compared with Reference Populations

Compared to the reference populations, patients with PE were younger than patients with CHF ($n = 80$), but age did not differ in patients with COPD ($n = 105$) and AMI the previous year ($n = 107$) (Table 2). Patients with PE scored had a higher mean SF-36 score on all subscales, compared to patients with severe COPD or CRF ($P \leq 0.004$). The mean SF-36 scores were not significantly higher or lower than in patients with the first year after AMI on most scales; patients with PE only scored significantly higher on the vitality (62.7 vs. 57.7) ($p = 0.015$) and bodily pain (78.6 vs. 72.8) ($p = 0.018$) (Table 2 and Fig. 1).

QoL as Measured by the PEmb-QoL in PE Patients Treated for PE

The numbers of patients per complete PEmb-QoL scales were: 102 for frequency of complaints, 103 for ADL limitations, 102 for work related problems, 108 for social limitations, 104 for intensity of complaints, 92 for emotional complaints.

The median total PEmb-QoL score was 7.1 (IQR 6.1-10.8). The median scores of the 6 dimensions of the PEmb-QoL were: 1.7 (interquartile range (IQR) 1.0–2.1; max 5 points) for frequency of complaints, 1.5 (IQR 1.0–1.9; max 3 points) for limitations in ADL, 1.3 (IQR 1.0–1.5; max 2 points) for work-related problems, 1.5 (IQR 1.0–2.0; max 5 points) for social limitations, 2.0 (IQR 1.0–3.0; max 6 points) for intensity of complaints and 1.7 (IQR 1.0–3.0 max 6 points) for emotional complaints (Fig. 2).

Comparison of QoL Between the Short-Term and Long-Term Clinical Course, Measured by the SF-36 and PEmb-QoL

The scores on the SF-36 subscales physical functioning, social functioning, vitality were significantly higher in the group of patients who completed the questionnaire at least 15 months after PE, compared to patients who filled out the questionnaires within 15 months after diagnosis of PE (65.9 vs. 48.0, 81.0 vs. 67.1 and 64.7 vs. 54.8, respectively, $p < 0.05$). Scores on the SF-36 subscales: physical role functioning, emotional role functioning, mental health, bodily pain, and general health did not differ between the intermediate and the long-term follow-up (data not shown).

Table 2
Demographics and mean Short Form 36 (SF-36) scores in patients with pulmonary embolism (PE) (leaving out the patients with PE and COPD or CHF), compared to the gender and age adjusted Dutch population norms, patients with severe to very severe Chronic Obstructive Pulmonary Disease (COPD), Congestive Heart Failure (CHF), and myocardial infarction (AMI), the previous year [11,15,16].

	Total PE N = 98	Dutch population N = 140	COPD N = 105	Heart failure N = 80	AMI the previous year n = 107
Female n (%)	50 (51)	91 (65)	40 (38)	26 (32.5)	33 (31)
Age mean (SD)	60.4 (15.0)	59 (range 55-64)	66.3 (9.2)	76.2 (8.3)	59.2 (11.4)
Care	secondary	N.A.	secondary	secondary	primary
Physical functioning	70.6	72.7	21.0	24.7	69.7
Mean (SD)	(32.4)	(24.4)	(21.1)	(23.0)	(26.1)
p-value*		0.40	<0.00001	<0.00001	0.78
Social functioning	79.3	86.6	65.0	58.6	81.6
Mean (SD)	(25.8)	(21.4)	(26.1)	(31.6)	(21.1)
p-value*		0.0008	<0.00001	<0.00001	0.39
Role physical	64.5	76.5	37.1	37.8	72.8
Mean (SD)	(45.1)	(38.1)	(42.8)	(43.0)	((25.2)
p-value*		0.002	<0.00001	<0.00001	0.36
Role emotional	79.6	90.1	62.9	67.1	73.5
Mean (SD)	(38.6)	(24.5)	(44.9)	(42.9)	(38.0)
p-value*		<0.00001	<0.00001	0.004	0.10
Mental	77 .0	77.1	68.6	71.3	75.8
Mean (SD)	(17.5)	(18.7)	(19.9)	(21.2)	(15.7)
p-value*		0.96	<0.00001	0.003	0.48
Vitality	62.7	67.0	51.1	48.7	57.7
Mean (SD)	(21.3)	(21.3)	(18.9)	(19.8)	(19.0)
p-value*		0.046	<0.00001	<0.00001	0.015
Pain	78.6	74.7	70.9	61.1	72.8
Mean (SD)	(25.5)	(25.0)	(29.5)	(31.4)	(25.2)
p-value*		0.084	0.002	<0.00001	0.018
General health	55.4	64.4	29.7	37.2	59.2
Mean (SD)	(26.8)	(22.2)	(19.1)	(17.3)	(19.3)
p-value*		<0.00001	<0.00001	<0.00001	0.14

SD standard deviation.
* 2-sided p-value for Z score, patients with PE versus general population, and patients with COPD, CHF and AMI, the previous year, versus patients with PE.

The PEmb-QoL scores of the patients who completed the questionnaires within 15 months after diagnosis of PE did not differ from the results of the patients who filled out the questionnaires longer than 15 months after diagnosis of PE (data not shown), except for the scales emotional complaints: 2.1 (IQR 1.2-3.2) versus 1.6 (IQR 1.0-1.9) respectively, p = 0.028 and limitations in ADL 1.7 (IQR 1.1-2.2) versus 1.5 (IQR 1.0-1.7) respectively, p = 0.03.

Associations Between Clinical Characteristics and the PEmb-QoL

The total PEmb-QoL score did not correlate with age, BMI, COPD, CHF, history of VTE, recurrent PE, malignancy, smoking habits (partial correlations as we adjusted for time between PE and filling out the questionnaires). PEmb-QoL was neither related to localization of PE, thrombus load expressed as Qanadli score, nor the time span between PE and inclusion.

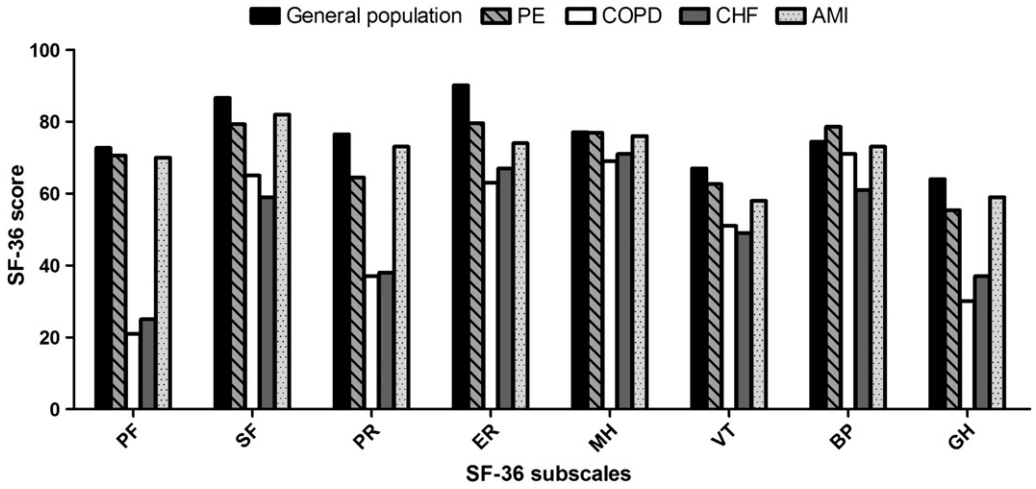
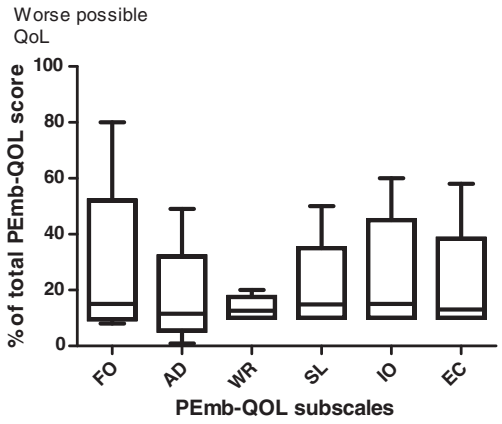


Fig. 1. Mean SF-36 scores of patients with a history of acute Pulmonary Embolism, compared to a Dutch general population and disease comparison groups: COPD chronic obstructive pulmonary disease, CHF congestive heart failure, and AMI acute myocardial infarction, the previous year.



Median (IQR) PEmb-QoL scores		
FO	1.7 (1.0–2.1)	Max 5
AD	1.5 (1.0–1.9)	Max 3
WR	1.3 (1.0–1.5)	Max 2
SL	2.0 (1.0–3.0)	Max 5
IO	2.0 (1.0–3.0)	Max 6
EC	1.7 (1.0–3.0)	Max 6

Legend	
FO	Frequency of complaints
AD	ADL limitations
WR	Work related problems
SL	Social limitations
IO	Intensity of complaints
EC	Emotional complaints

Fig. 2. Results of the PEmb-QoL scores of patients with a history of acute pulmonary embolism. Scores are presented as median with interquartile range. Minimum score for all six subscales was 1; maximum scores are presented (below) between brackets. Higher PEmb-QoL scores reflect decreased quality of life.

Of the 6 PEmb-QoL dimensions, modest correlations were found between COPD and intensity of complaints ($r = 0.23$, $p = 0.02$) and social limitations ($r = 0.28$, $p = 0.025$), CHF and social limitations ($r = 0.28$, $p = 0.003$), malignancy and emotional complaints ($r = 0.24$, $p = 0.023$), time span between PE and inclusion and emotional complaints ($r = -0.2$, $p = 0.04$), and ADL limitations ($r = -0.20$, $p = 0.008$).

Discussion

This study demonstrated that PE patients reported a worse QoL compared to the general Dutch population. Nevertheless, patients treated for PE reported a better QoL compared to patients with chronic cardiopulmonary conditions and their QoL was comparable with patients with an acute cardiopulmonary condition. Time period after assessment seemed to affect scores on several subscales. Clinical characteristics did not correlate with QoL as measured by PEmb-QoL.

Until now, only few studies addressed the QoL of patients with acute PE. Klok and colleagues [3] assessed the SF-36 in 392 patients with a history of PE and compared their SF-36 scores to Dutch population norms. They found significant differences on all subscales of the SF-36, indicating a decreased QoL in patients treated for PE. The time interval between PE and study inclusion was inversely related to QoL, and significant determinants of poor QoL were prior PE, age, obesity, active malignancy, and cardiopulmonary comorbid conditions [3]. Our results are partly in accordance with this study, as we found some subscales to be decreased compared to the Dutch population norms. Furthermore we found a modest correlation between COPD, CHF, malignancy and time span between PE and inclusion, and no correlation was found for all other clinical characteristics. An explanation for the differences in results between the study of Klok et al., and our study, could be that the current study represents a healthier population as reflected by the lower rates of cardiopulmonary comorbidity (8% versus 48%). In addition, the current analysis had a smaller time-window between the PE episode and QoL-measurement, which has been demonstrated to be inversely related with QoL [18]. The PEmb-QoL has been validated in 2010 in 90 patients with a history of PE [9]. The median time between PE and inclusion in that study was 3 years and 2 months, (range 10 months –approximately 8 years). The median PEmb-QoL scores were all slightly lower in the previous cohort, indicating a better QoL, possibly due to the larger time gap between PE and inclusion.

Since recent data revealed that a large proportion of patients with acute PE experience an adverse clinical course [8], it could be debated whether PE should be considered an acute or a chronic disease. Therefore, we investigated to what extent the QoL of patients with acute PE compares to the QoL reported by patients with chronic cardiopulmonary diseases (i.e. COPD and CHF) and an acute cardiopulmonary condition (i.e. AMI), using the generic SF-36 questionnaire. Notably, the QoL of patients with acute PE was significantly better on all SF-36 subscales. Furthermore, no clear differences were seen when we compared the QoL status of our patients to that of patients with a history of AMI the previous year. These findings therefore indicated that QoL in patients with acute PE resembles more an acute, than a chronic cardiopulmonary disease. These findings may be supported by the fact that for some subscales of both questionnaires, we observed that the longer the period between the diagnosis and the QoL measurement, the better the QoL outcome. By using a generic QoL questionnaire (SF-36), we were able to compare QoL between groups, whereas by using a disease-specific instrument we were able to evaluate the disease-specific aspects of QoL in patients treated for PE.

To our knowledge, this is the first study that investigated the correlation between thrombus-load, as expressed by the Qanadli score and the location of the thrombus (i.e. central or lobar, segmental and subsegmental), and QoL, as assessed with the PEmb-QoL questionnaire, in patients with PE. More centrally located PE or a higher thrombus load did not appear to affect QoL on the long-term. Although thrombus load has clearly been established as an important predictor for the short-term clinical outcome [19], its implications for the long-term clinical course, including the risk of developing CTEPH, have yet to be established.

The conclusions of this study are strengthened by the high response rate of 73%. A limitation includes the relatively low sample size. As a consequence, this study might have been underpowered to detect significant correlations between clinical characteristics and QoL assessed by PEmb-QoL. Additionally, our patient sample represents a relative healthy population, which is likely inherent to the fact that the patients had to survive the first months following PE to enter the study. However, in our view, this cohort does represent the population of PE patients in whom assessing the QoL after PE is relevant. Furthermore, we measured both questionnaires once, which might give a bias as symptoms might change over time. Although the question “Would you have been worried if you had to stop taking anticoagulant medication?" was not directly relevant for 84% of the patients, it could be interpreted as "were you worried when you had to stop taking anticoagulants". In addition, we are unable to compare the observed differences between patients with PE and patients with other cardiopulmonary diseases, to previous literature. Therefore, unfortunately, we are unable to draw conclusions whether the differences we observed are clinically meaningful.

In summary, patients with a history of acute PE reported an impaired QoL compared to the general population. The presented population of patients with a history of acute PE reported better QoL compared to patients with COPD and CHF, whereas QoL of PE patient was comparable to patients with AMI. The results of this study increase the knowledge about the psychosocial consequences of acute PE and its treatment.

Disclosures

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References

[1] Wilson IB, Cleary PD. Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. JAMA 1995;273:59–65.
[2] The World Health Organization Quality of Life assessment (WHOQOL): position paper from the World Health Organization. Soc Sci Med 1995;41:1403–9.
[3] Klok FA, van Kralingen KW, van Dijk AP, Heyning FH, Vliegen HW, Kaptein AA, et al. Quality of life in long-term survivors of acute pulmonary embolism. Chest 2010;138:1432–40.
[4] Hemingway H, Marmot M. Evidence based cardiology: psychosocial factors in the aetiology and prognosis of coronary heart disease. Systematic review of prospective cohort studies. BMJ 1999;318:1460–7.
[5] Becattini C, Agnelli G, Prandoni P, Silingardi M, Salvi R, Taliani MR, et al. A prospective study on cardiovascular events after acute pulmonary embolism. Eur Heart J 2005;26:77–83.
[6] Salaffi F, Carotti M, Grassi W. Health-related quality of life in patients with hip or knee osteoarthritis: comparison of generic and disease-specific instruments. Clin Rheumatol 2005;24:29–37.
[7] Bombardier C, Melfi CA, Paul J, Green R, Hawker G, Wright J, et al. Comparison of a generic and a disease-specific measure of pain and physical function after knee replacement surgery. Med Care 1995;8:523–32.
[8] Klok FA, Zondag W, van Kralingen KW, van Dijk AP, Tamme JT, Heyning FH, et al. Patient outcomes after acute pulmonary embolism. A pooled survival analysis of different adverse events. Am J Respir Crit Care Med 2010;181:501–6.
[9] Klok FA, Cohn DM, Middeldorp S, Scharloo M, Büller HR, van Kralingen KW, et al. Quality of life after pulmonary embolism: validation of the PEmb-QoL Questionnaire. J Thromb Haemost 2010;8:523–32.
[10] Cohn DM, Nelis EA, Busweiler LA, Kaptein AA, Middeldorp S. Quality of life after pulmonary embolism: the development of the PEmb-QoL questionnaire. J Thromb Haemost 2009;7:1044–6.
[11] Stewart AL, Greenfield S, Hays RD, Wells K, Rogers WH, Berry SD, et al. Functional status and well-being of patients with chronic conditions. Results from the Medical Outcomes Study. JAMA 1989;262:907–13.
[12] Es van J, Douma RA, Gerdes VE, Kamphuisen PW, Büller HR. Acute pulmonary embolism. Part 2: treatment. Nat Rev Cardiol 2010;7:613–22.
[13] Lee AY, Levine MN, Baker RI, Bowden C, Kakkar AK, Prins M, et al. Low-molecular-weight heparin versus a coumarin for the prevention of recurrent venous thromboembolism in patients with cancer. N Engl J Med 2003;349:146–53.
[14] Ware Jr JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care 1992;30:473–83.
[15] Van der Zee KI, Sanderman R, Heyink J. De psychometrische kwaliteiten van de MOS 36-item Short Form Health Survey (SF-36) in een Nederlandse populatie. Tijdschr Soc Gezondheidsz 1993:183–91.
[16] Janssen DJ, Franssen FM, Wouters EF, Schols JM, Spruit MA. Impaired health status and care dependency in patients with advanced COPD or chronic heart failure. Qual Life Res 2011;20:1679–88.
[17] Qanadli SD, El Hajjam M, Vieillard-Baron A, Joseph T, Mesurolle B, Oliva VL, et al. New CT index to quantify arterial obstruction in pulmonary embolism: comparison with angiographic index and echocardiography. AJR Am J Roentgenol 2001;176:1415–20.
[18] Pietrobon R, Coeytaux RR, Carey TS, Richardson WJ, DeVellis RF. Standard scales for measurement of functional outcome for cervical pain or dysfunction: a systematic review. Spine (Phila Pa 1976) 2002;27:515–22.
[19] Wong LF, Akram AR, McGurk S, Van Beek EJ, Reid JH, Murchison JT. Thrombus load and acute right ventricular failure in pulmonary embolism: correlation and demonstration of a "tipping point" on CT pulmonary angiography. Br J Radiol 2012;85:1471–6.