Impact of gender, age, and comorbidities on quality of life in patients with chronic rhinosinusitis*

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SUMMARY

Statement of the problem: *To evaluate the impact of gender, age and comorbidities of health-related quality of life (HR-QOL) assessments in patients with chronic rhinosinusitis.*

Methods: *The prospective administration of the German Adapted Version of the Sino-Nasal Outcome Test 20 (SNOT-20 GAV) to patients with chronic rhinosinusitis. Two hundred and two patients with chronic rhinosinusitis filled out the questionnaire before functional endoscopic sinus surgery (FESS) and again at the 3-month follow-up.*

Main results: *Gender had a significant impact on the Overall Score (OS) and on the General Quality of Life Score (GQOL) of the SNOT-20 GAV, but no influence on the disease-specific scores of 'Primary Nasal Symptoms' (PNS) and 'Secondary Rhinogenous Symptoms' (SRS). Age did not influence HR-QOL. Patients with comorbidities demonstrated lower HR-QOL scores.*

Principal conclusion: *Women had significantly poorer QOL scores than men. It seems that the influence of gender reflects general HR-QOL views rather than illness-related expectations.*

Key Words: Quality of life, chronic sinusitis, gender, age, comorbidities

INTRODUCTION

Within the last decade the data assessment of health related quality of life (HR-QOL) has become an established standard addendum in outcome research. Consequently international clinical rhinological research paid more attention to quality outcome and several valid instruments have been designed in order to detect variables influencing QOL measures and treatment effectiveness [1-3]. It is very important to have valid measuring instruments for assessing rhinosinusitis health status and treatment efficacy in Germany as rhinosinusitis affects about 10 to 15% of the German population [4]. Moreover, its impact on health status relative to the general German population has not been thoroughly investigated or extensively assessed. For example, Gliklich and Metson suggested in their study on the burden of chronic sinusitis that the national health impact in the United States turned out to be much greater than expected [1,2]. Furthermore, when compared with other chronic diseases patients with chronic rhinosinusitis showed significantly lower scores (SF-36) in bodily pain and social functioning in comparison to other diseases.

Furthermore, one of our recent SF-36 studies on patients with chronic rhinosinusitis demonstrated that gender, but not age, had a significant effect on the assessment of general HR-QOL [5]. In the present study we used the Sino-Nasal Outcome Test-20 German Adapted Version (SNOT-20 GAV) to assess the influence of age, gender, and comorbidities on QOL in patients with chronic rhinosinusitis. The SNOT-20 GAV is a validated German translation and modification of the American SNOT-20 and has demonstrated good reliability, validity, and responsiveness [1,6]. The American SNOT-20 scores reflect health impacts, i.e. the general health burden experienced by the patient. In addition SNOT-20 is very sensitive to clinical change. We modified the German version of SNOT-20 by changing 3 items. Based on many years of clinical experience we substituted 'need to blow nose' with 'nasal obstruction' because 'sneezing', 'thick nasal discharge', and 'runny nose' in the SNOT-20 inventory already describe the health burden effectively. Consequently we considered the number of times a patient blows his/her nose superfluous since it does not contribute to the overall score. 'Lack of good

sleep' and 'wake up tired' was substituted with 'dry throat/need to harrumph' and 'loss of smell'. The items 'nasal obstruction' and 'loss of smell' were introduced due to the recent definition of chronic rhinosinusitis [7]. We decided not to include the patient rating whereupon patients are asked to indicate the 5 items most important to them. Instead we introduced three sub-scores (primal nasal symptoms, PNS; secondary rhinogenic symptoms, SRS; general quality of life, GQOL) in order to afford more detailed analyses.

In general little is known about long-term rhinosinusitis treatment effects. One of the reasons is that treatment evaluation is hindered by a lack of valid measuring tools to assess disease-specific health status and HR-QOL [1]. By incorporating both measures (health status and QOL) into one questionnaire rhinosinusitis treatment could promote treatment standardization and facilitate treatment evaluation in terms of accuracy and clinical relevance.

The goals of this study were to test if the significant gender differences found in our recent study with a generic QOL instrument (SF-36) on patients with chronic sinusitis could be confirmed with the generic scale of the SNOT-20 GAV (GQOL) and could also be measured with the disease-specific scales of the SNOT-20 GAV (PNS, SRS) with a similar patient population. Furthermore, we were interested to find out whether age and comorbidities influenced HR-QOL ratings.

MATERIALS AND METHODS
Patients: symptoms and treatment
Two hundred and two patients were recruited and studied from August 1, 2002 to November 30, 2003 of whom 96 were evaluated. The selection procedure is summarized in Figure 1.
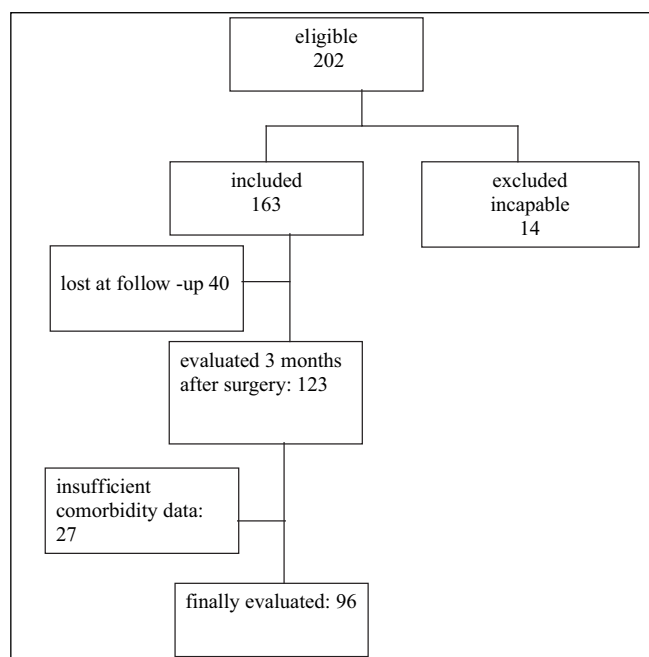

Figure 1. Selection procedure from eligible to final patient sample.

All patients had chronic rhinosinusitis and were scheduled for paranasal sinus surgery. Chronic sinusitis criteria were based on rhinosinusitis guidelines: Symptoms longer than 12 weeks, computer tomography verification, and pathology specimen confirmation of chronic paranasal sinus infection [7]. Severity of chronic sinusitis and comorbidities differed in patients before surgery. Patients, comorbidities, surgeons, and surgical procedures are summarized in Tables 1 and 2. All patients provided informed written consent and the study was approved by the ethics committee of the University of Tuebingen Medical School (PR-NR 20/2003). Type of surgery was determined by septoplasty criteria and unilateral versus bilateral functional endoscopic sinus surgery (FESS). Post operatively all patients received standard medical treatment consisting of sequential application of nasal emulsions with Xylometazoline and Budenoside for three weeks followed by the application of topical steroids (Fluticasone) for at least another three months.

Table 1. Documented comorbidities.

Comorbidities	n	%
none	64	66
chronic lung disease	24	25
asthma	10	10
chronic obstructive pulmonary disease	14	15
diabetes mellitus without organ damage	7	7
diabetes mellitus with organ damage	2	2
peripheral vascular disease	3	3
heart disease	1	1
liver disease	1	1

Table 2. Patient and surgery characteristics. t-test for mean Lund-Mackay-Score and Fisher's exact test for all other characteristics.

	Male	Female	Total	p-Value
n	61	35	96	
Mean Age	50,2	44,1	47,9	0,04
Mean Lund-Mackay Score	9,5	11,1	10,1	0,28
Charlson Comorbidity Index				
0	40	24	64	0,42
1	14	11	25	
2	4	0	4	
3	2	0	2	
4	1	0	1	
Previous Surgery				
Primary Surgery	49	27	76	0,8
Revision Surgery	12	8	20	
Surgical Experience				
Experienced	44	30	74	0,14
Inexperienced	17	5	22	
Performed Surgery				
Septoplasty	46	25	71	0,51
Unilateral FESS	3	7	10	
Bilateral FESS	58	28	86	
Partial Ethmoidectomy	40	24	64	
Total Ethmoidectomy	21	11	32	

Data assessment

Data assessment comprised the following parameters: Age, gender, visible pathological anatomical changes in the CT utilizing the Lund-Mackay-Score, comorbidities determined by the Charlson Comorbidity Index (CCI), number of nasal surgeries, and surgeons classified according to endonasal sinus surgery experience [8,9]. A surgeon was rated experienced if he had five years or more FESS experience. Data were collected from patients' files.

One day before surgery each patient together with the first author filled out the SNOT-20 GAV. Fill-out time took about 10 minutes. Three months after surgery the patients received the same questionnaire by mail with the instructions to post the filled-out questionnaires in pre-paid included envelopes.

The patients assessed their HR-QOL with the 20-Item Sino-Nasal Outcome Test German Adapted Version by selecting one out of five possible answers for each item. The possible score for each item ranges from 0 to 5 with a higher score demonstrating a greater rhinosinusitis health problem. The overall score (OS) and sub-scores are calculated by using a normalized scale of 0 to 100, with 0 being the worst and 100 the best score.

The sub-score 'primal nasal symptoms' (PNS) comprises the items 'nasal obstruction', 'sneezing', 'runny nose', 'thick nasal discharge', 'loss of smell'. The sub-score 'secondary rhinogenic symptoms' (SRS) consists of 'post-nasal discharge', 'dry throat/need to harrumph', 'cough', 'ear fullness'; 'ear pain', and 'facial pain/pressure'. The sub-score 'general quality of life (GQOL) comprises the following items: 'dizziness', 'difficulty falling asleep', 'wake up at night', 'fatigue', 'reduced productivity', 'reduced concentration', 'frustrated/restless/irritable', 'sad', and 'embarrassed'.

Statistics

We employed the JMP® version 5 (SAS institute Inc., Cary, NC, USA) for statistical data evaluation and used t-tests for independent means or Fisher's exact test for between group differences and t-test for dependent means for within group differences. Furthermore, we used multivariate linear regression analysis and multivariate analysis of variance (MANOVA). The significance level for all tests was set at $p < 0.05$.

Power calculations were performed with nQuery Advisor, Version 4.0 (Statistical Solutions, Saugus, MA, USA). They were calculated for FESS effects (t-test for dependent means for within group differences) and for the variables being examined (gender, age, and comorbidities; t-test for independent means).

RESULTS

We analyzed the response behaviors of all our patients in order to correct for possible selection and response bias. More women than men participated in the postoperative survey but this was not statistically significant (p = 0.405, Fisher's exact test). Moreover, the initially accepted patient sample (n = 163) did not differ significantly from the final sample (n = 96) in

terms of age (p = 0.164, t-test) or gender (male patients p = 0.331; female patients p = 0.207, t-test). In addition, more patients with comorbidities returned filled out surveys postoperatively than patients without comorbidities (p = 0.015, Fischer's exact test).

Patient and surgery characteristics are presented in Table 2. Female patients were somewhat younger than male patients (p = 0.04, t-test).

Power calculations revealed that all FESS effects could be analyzed with the existent data set. We found a 99% power for all t-tests for dependent means for within group differences. For the examined variables (gender, age, and comorbidities) we calculated scale value differences that could be detected with a power of 80% using a two group t-test with a 0.05 two-sided significance level. While this difference usually is postulated as a count of 10 when using a 0-100 scale our mean detectable difference for all baseline and 3 months postoperative sub-scores was 10.7 (range 9.3-12.3) for gender, 10.3 (range 8.7-11.8) for age, and 10.9 (range 9.5-12.6) for comorbidities.

SNOT-20 GAV analyses

Both male as well as female patients achieved significantly better SNOT-20 GAV scores after the 3-month follow-up than before surgery. Statistics are presented in Table 3. No significant differences could be detected in female versus male patients after follow-up for the 'overall score' (OS) or the score 'general quality of life' (GQOL) while there were significant differences at baseline.

Age had no significant effect on baseline and follow-up scores. This was demonstrated with Pearson's correlation analysis and by group dichotomization based on the age median. Our findings revealed that both patient groups - young and old

Table 3. Patient gender comparisons.

	Male		Female	p-Value
	mean (95% CI)		mean (95% CI)	
OS		Baseline		0.04
	32.7 (28.9-36.5)		39.2 (34.3-44.1)	
		3 Months		0.12
	16.2 (12.8-19.6)		20.7 (16.3-25.1)	
p-Value	< 0.0001		< 0.0001	
PNS		Baseline		0.47
	48.5 (43.2-53.8)		51.7 (44.8-58.6)	
		3 Months		0.42
	19.6 (15.6-23.6)		22.3 (16.7-27.5)	
p-Value	< 0.0001		< 0.0001	
SRS		Baseline		0.58
	30.2 (25.7-34.7)		32.2 (26.3-38.1)	
		3 Months		0.30
	16.2 (12.2-20.2)		19.6 (14.3-24.9)	
p-Value	< 0.0001		< 0.0001	
GQOL		Baseline		0.01
	25.6 (20.8-30.4)		36.9 (30.6-43.2)	
		3 Months		0.09
	14.3 (9.9-18.7)		20.4 (14.5-26.3)	
p-Value	< 0.0001		< 0.0001	

−attained significantly lower scores on all items after follow-up ($p < 0.05$, t-test).

Patients with and without comorbidities scored significantly lower on all scores after follow-up. Statistics are presented in Table 4. However, in comparison to patients with comorbidities patients without comorbidities achieved lower scores both before and after surgical intervention for the 'overall score' and the sub-scores '

Multivariate linear regression analysis revealed a significant influence of gender on the Overall Score preoperatively and the GQOL sub-score both pre- and postoperatively. Furthermore, comorbidities had a significant impact on the Overall Score and the PNS and GQOL sub-scores pre- and postoperatively. We could not detect any influence of age in this analysis. These results were verified by MANOVA, which yielded a supplemental influence of comorbidities on the SRS sub-scale ($p = 0.04$).

DISCUSSION

We found no evidence for selection bias. While more patients with comorbidities returned filled out surveys postoperatively than patients without comorbidities response bias might exist in terms of comorbidities. Power calculations revealed an adequate sample size for both evaluation of FESS effects and analysis of influencing variables.

Influence of gender

Gender differences in the subjective evaluation of health status have been described for various clinical conditions, including irritable bowel syndrome and coronary heart disease [10,11]. A higher capacity for sensory discrimination and a resulting greater capacity to perceive pain for women compared to men have also been reported [12]. Gender differences have also been reported for objective measurements at the sensory organs. In a study on objective olfactory chemosensory perception with different concentrations of pyridines, women reported higher levels of intensity and discomfort regarding the irritant, and detected significantly more identifiable early components (P1, N1) in the recordings of the chemosensory event-related potentials [13].

Gender related differences have also been reported in recent times for patients with chronic rhinosinusitis. A study by the Royal College of Surgeons of England published in 2003 reported for the first time higher preoperative complaint scores for women in the SNOT-22 despite a reduced extent of disease in the CT scans of the nasal sinuses [14]. Studies by our group using the German version of the SF-36 Health Survey have confirmed these results for the pre-operative state, but a convergence of scores was then found between men and women postoperatively [5,15]. In the study submitted here, we confirmed the previously detected differences with the generic GQOL score and the OS, but could not establish gender related differences either pre- or postoperatively for the disease-specific scores (PNS and SRS) (Table 3). As such the influence

Table 4. Comorbidity comparisons. CCI=Charlson Comorbidity Index.

	CCI[1]=0	CCI>0	p-Value
	mean (95% CI)	mean (95% CI)	
OS		Baseline	0.001
	31.7 (28.1-35.3)	41.8 (36.8-46.8)	
		3 Months	0.004
	15.0 (11.8-18.2)	23.4 (18.8-28.0)	
p-Value	< 0.0001	< 0.0001	
PNS		Baseline	0.003
	45.2 (40.3-50.1)	58.4 (51.5-65.3)	
		3 Months	0.004
	16.7 (13.1-20.3)	28.4 (23.3-33.5)	
p-Value	< 0.0001	< 0.0001	
SRS		Baseline	0.095
	28.8 (24.5-33.1)	35.1 (29.0-42.2)	
		3 Months	0.10
	15.6 (11.8-19.4)	21.1 (15.6-26.6)	
p-Value	< 0.0001	< 0.0001	
GQOL		Baseline	0.008
	26.0 (21.3-30.7)	37.2 (30.6-43.8)	
		3 Months	0.024
	13.7 (9.4-18.0)	22.2 (16.1-28.3)	
p-Value	< 0.0001	< 0.0001	

of gender seems to be restricted primarily to the evaluation of aspects of general HR-QOL whereas the disease-specific HR-QOL was not judged differently by men and women.

Influence of age

We were able to demonstrate that the variable 'age' had no significant effect on SNOT-20 GAV scores. Another study by Brown et al. also supports our findings. This study (3128 patients), by far the largest comparative audit ever done on nasal polyposis and chronic rhinosinusitis demonstrated that patients' age had no effect on SNOT-22 scoring behavior [14]. Furthermore, Radenne et al. was also able to show that age in nasal polyposis patients did not correlate with SF-36 scores [16]. Thus, at this time it seems that age has no effect on HR-QOL in patients with chronic rhinosinusitis.

Age-related QOL assessments are very rare in otolaryngologic literature. Nevertheless, influence of age on HR-QOL assessment has been demonstrated e.g. in patients with breast cancer or depression [17,18]. Therefore, one should always be aware that age potentially plays an important role in QOL assessment.

Influence of comorbidities

Patients with chronic rhinosinusitis are generally healthy, since only 3.9% of patients (n=3128) in the study by the Royal College of Surgeons of England had to be assigned an ASA grade of 3 or higher [14]. Despite this the comorbidities of the patients in our study had a clear influence on the evaluation of HR-QOL and were reflected pre-operatively in three of the four scales of the SNOT-20 GAV (OS, PNS, GQOL). In each case an advantage was evident for the patients without comorbidities. These differences were also evident postoperatively,

whereby in both groups significant improvements were evident. It can therefore be assumed that an influence of comorbidity on the health related quality-of-life persists postoperatively with this clinical condition.

The by far most frequent comorbidity in our patient collective was chronic pulmonary disease (asthma, COPD) (Table 1) in 24 of 96 patients (25%). Positive effects of nasal sinus surgery have been described for patients with asthma [19, 20]. Reduced necessity of intake of steroids, shorter hospitalizations, improved pulmonary function and improvement in subjective well-being were usually reported. Our own patients also reported significant improvements in well-being and clinical symptoms. The low level of symptoms in patients without comorbidities, however, could not be achieved.

Potential weaknesses of the study

The study comprises a relatively small sample size and short follow-up, which might potentially limit its clinical significance. Thus we were unable to use correlation statistics in terms of evaluating comorbidities but used a dichotomous evaluation of CCI as 0 vs. > 0 which is less illustrative. Nevertheless, analyses in the study by Brown et al. on 3.128 patients demonstrated similar results for the influence of gender and age [14]. Another study showed that quality of life improvements remained stable during a long-term follow-up of three years [21].

The questionnaires in the survey were first administered by one of the authors, and distributed the second time by mail. These different administration procedures may have incurred a response bias. Some patients might have filled out the questionnaires only because of the presence of the interviewing person. Furthermore, patients might have assessed their quality of life before surgical treatment in the way they thought would satisfy the expectations of the interviewer. This potential influence was missing during the second survey and should not be ignored when interpreting the data.

CONCLUSION

Summarizing our results, women had significantly worse HR-QOL scores than men. The gender of the patients mainly influenced general HR-QOL scores, while differences were not significant for disease-specific aspects. An influence of patient age on quality-of-life could not be verified. The existence of comorbidities, particularly chronic pulmonary disease, led to a subjectively reduced quality-of-life. This influential factor also remained relevant postoperatively.

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