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Septal Perforation Quality of Life questionnaire (SEPEQOL): validation of a new instrument to assess patients undergoing endoscopic repair of a nasal septal perforation

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Abstract

Purpose Nasoseptal perforations (NSP) are a clinically heterogeneous group of disorders with a wide range of available treatments. Patient-reported outcome measures (PROMs) can provide valuable insights for assessing clinical and surgical outcomes. This study aims to develop and validate a novel-specific questionnaire for patients with NSP.

Methods A multi-centre prospective observational study was conducted at two tertiary referral hospitals. "**Se**ptal **Pe**rforation **Q**uality **o**f **L**ife" (SEPEQOL) was developed by a committee of experts. The psychometric properties, including reproducibility, reliability, validity, and responsiveness, were assessed.

Results The study included 96 symptomatic NSP patients and 30 healthy controls. SEPEQOL internal consistency was satisfactory [Cronbach´s α = 0.7843; 95% confidence interval (CI), 0.702–0.856]. Test-retest reliability was excellent, demonstrated by the absolute intraclass correlation (ICC = 0.974; 95% CI, 0.935–0.989, *P-value* < 0.001) and Bland-Altman plot (line bias = 1.6 ± 4.57; 95% CI -0.54–3.74, *P-value* < 0.001). The mean total SEPEQOL score was higher before surgery (25.16 ± 1.65) compared to 6-months after the procedure (13.72 ± 11.39), with a mean difference of 12.19 [standard deviation (SD) 10.76], *P-value* < 0.001.

Conclusions SEPEQOL is reliable, consistent, valid, and sensitive to change over time. SEPEQOL assesses the impact of health-related quality of life on NSP and its management in clinical practice. Moreover, it is easy to apply in clinical settings with minimal burden.

Keywords Health-related quality of life, Nasoseptal perforation, Objective outcomes, Specific quality of life questionnaire

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Introduction

Nasoseptal perforation (NSP) is a condition characterised by a defect of the nasal septum, which creates a communication between both nasal cavities [1, 2]. Prevalence of NSP is estimated to be 1.2% in the general population [1–3]. Some patients suffer bothersome symptoms such as epistaxis, crusting, whistling, nasal obstruction, facial pain, or loss of smell, which significantly impact their quality of life (QOL) [1, 2, 4, 5]. There are numerous surgical techniques described in the literature for NSP repair, but there is no evidence of the most suitable technique for patients who are refractory to medical treatment [1, 2, 4, 6]. Most studies have focused on the success of surgical closure, but only a few reports assess symptom resolution after surgery [7–9]. The effectiveness of surgical procedures cannot be judged solely based on technical success; changes in patient QOL must also be considered [9].

The analysis of health-related quality of life (HRQOL) is an area of increasing research in the literature. The term "HRQOL" assesses aspects of the disease that are not strictly clinical but are related to the patient's daily life and how it is affected by the pathology [10]. Assessing HRQOL involves using patient-reported outcome measures (PROMs). PROMs are reports directly from the patients concerning how they feel and function to a health condition and its therapy [10–12]. HRQOL must be systematically evaluated to better understand the patient´s evolution and adaptation to the disease and the side effects of treatment [13].

In patients with NSP, detailed knowledge of HRQOL could help surgeons improve patient management and identify poor prognosis data during follow-up. Moreover, patients´ access to detailed information about their disease promotes a better adaptation to their medical condition. Unfortunately, few publications collect data on patients' symptoms using general questionnaires or other sinonasal disease questionnaires that do not include cardinal symptoms of NSP.[7, 8, 14–17] In the era of evidence-based medicine, a validated tool is needed to systematically measure patient symptoms in this population.

Currently, there is only one NSP-specific validated questionnaire to assess the symptoms of English-speaking patients, the NOSE-Perf Scale. [18] Nevertheless, it has some limitations. For instance, it does not evaluate aesthetic changes often associated with large NSP and does not assess patients' functionality and emotionality. A Spanish-validated version of the questionnaire has recently been published; however, its responsiveness has not been studied. This limits the application of the questionnaire in patient follow-up and the advancement of our knowledge about the management of this challenging disease[19].

Therefore, the aim of the present study was to design and validate an innovative specific questionnaire "Septal Perforation Quality of Life" (SEPEQOL) specifically tailored for Spanish-speaking patients with NSP, aiming to enhance understanding of this condition and streamline the clinical practice.

Materials and methods

A prospective, observational, multicentre study was performed between January 2021 and May 2023 in the Rhinology and Anterior Skull Base Unit of the Department of Otolaryngology at two tertiary reference care centres: Ramón y Cajal Hospital (Madrid) and Hospital Clinic (Barcelona). The study was approved by the Ethics Committee of both centres (PERFOSEPTO.1 and HCB/2021/0170). All patients provided informed consent to participate in the study.

Questionnaire design

A preliminary NSP-specific questionnaire was developed using a three-stage Delphi consensus procedure. Initially, a committee of three experts conducted a literature review [1, 2, 4, 5, 7, 9, 15, 16, 18] and focused on the main complaints of patients with NSP. We asked three experienced rhinologists, with numerous publications in the field, to create an open-ended questionnaire based on their extensive expertise. A group of fifteen patients with NSP was consulted to provide feedback on the relevance and clarity of the proposed items. A semi-structured script was produced by summarizing the proposed items. Afterward, experts received the questionnaire again to rate the items and determine their priorities. Finally, the three experts received the final version of "SEPEQOL" to review their judgments. SEPEQOL consisted of 12 self-report items presented on a 5-point Likert-type scale. The total score ranged from 0 to 48, with higher scores indicating worse HRQOL due to more severe symptoms (Fig. 1).

Validation study

Patients with symptomatic NSP aged over 18 years were consecutively enrolled. Exclusion criteria included upper respiratory tract infection, psychiatric or neurocognitive disease, nasal inflammatory disease, previous head and neck radiotherapy, history of nasal tumours, or nasal surgery other than septoplasty.

All patients underwent a complete clinical history and physical examination, including nasal endoscopy, to exclude concomitant sinonasal pathology. The aetiologies of NSPs were classified as postsurgical, nasal picking, drug consumption, idiopathic, granulomatous disease, and vasoconstrictive nasal spray use. A computed tomography (CT) scan of the paranasal sinuses was performed to determine the location of the NSP and to plan surgery.

Cuestionario SEPEQOL	No es un problema (0)	Problema muy leve (1)	Problema moderado (2)	Problema bastante serio (3)	Problema grave (4)	Total
1. Congestión nasal	6	13	16	34	27	2.66 ± 1.20
2. Obstrucción nasal	7	13	12	36	28	2.68 ± 1.24
3. Problemas para dormir	12	15	19	30	20	2.32 ± 1.31
4. Incapacidad para respirar por la nariz suficiente al realizar ejercicios físicos	12	13	19	27	25	2.42 ± 1.37
5. Costras nasales	10	12	11	25	38	2.72 ± 1.37
6. Silbidos nasales con la respiración	28	17	21	19	11	1.67 ± 1.38
7. Sangrado nasal	36	14	23	10	13	1.48 ± 1.43
8. Dolor o presión facial	34	11	26	18	7	1.51 ± 1.34
9. Alteraciones en el olfato	41	17	12	12	14	1.39 ± 1.50
10. Secreción nasal espesa	26	13	18	20	19	1.93 ± 1.50
11. Necesidad de sonarse la nariz	13	13	18	23	29	2.44 ± 1.40
12. Cambios estéticos en mi nariz	56	15	18	8	4	1.11 ± 1.51
Total						25.16 ± 1.65

(a)

SEPEQOL questionnaire	Not a problem (0)	Very mild problem (1)	Moderate problem (2)	Fairly bad problem (3)	Severe problem (4)
1. Nasal congestion					
2. Nasal blockage or obstruction					
3. Trouble sleeping					
4. Unable to get enough air through my nose during exercise					
5. Nasal crusting					
6. Nose whistling					
7. Nose bleeding					
8. Headache or facial pain					
9. Smell dysfunction					
10. Thick nasal discharge					
11. Need to blow my nose					
12. Aesthetic changes in my nose					
Total					

(b)

Fig. 1 Septal Perforation Quality of Life (SEPEQOL) questionnaire. (**a**) Spanish-speaking version. Complete questionnaire distributed to the patients of the study. The total score for each item in NSP patients is provided in detail. (**b**) Cross-culturally adapted version of SEPEQOL questionnaire for English-speaking. Abbreviations: SEPEQOL, Septal Perforation Quality of Life; NSP, nasoseptal perforation

NSPs were classified based on the exit of the incisive canal to differentiate between anterior and posterior ones and their size was calculated by measuring their antero-posterior and superior-inferior diameters in CT, as recommended by Garaycochea O, et al [20].

Patients were asked to complete several questionnaires before, 3-months and 6-months after surgery, including the "Nasal Obstruction Symptom Evaluation" (NOSE), the "Sino-Nasal Outcome Test-22" (SNOT-22), a 10 cm "Visual Analog Scale" (EVA) measuring issues such as nasal obstruction, rhinorrhea, smell disorder, facial pain/pressure, and nasal whistling, crusting, and bleeding; and the SEPEQOL questionnaire. In addition, 20 NSP patients filled out the questionnaires twice, 4 weeks apart to ensure test-retest reliability. Controls completed the same questionnaires during the enrollment visit. Recruitment of healthy volunteers included individuals over 18 years old, consisting of hospital employees and patients visiting the ENT department for non-sinus-related complaints.

Statistical methods

Guidelines for HRQOL instrument validation were followed to study the psychometric properties of the novel instrument.[21] Questionnaires with missing items were excluded from the study.

Reliability valued by the internal consistency was calculated with Cronbach´s α coefficient in the entire sample and NSP patients separately. An α coefficient of ≥0.7 and an item-total correlation ranging from 0.30 to 0.70 were considered satisfactory. Reproducibility was studied by absolute and consistency intraclass correlations (ICCs). The strength of the ICC was classified as poor (<0.40); fair-good, (0.40–0.75); and excellent (>0.75).[22] Bland-Altman plot and Pearson correlation were used to assess the reproducibility of SEPEQOL. The Pearson correlation coefficient (r) was used to determine the correlation between the test-retest total scores.

To ensure content validity, the most significant symptoms were selected through the Delphi method. Discrimination validity was guaranteed by comparing SEPEQOL total scores between NSP patients and healthy controls using the T-Student test. Criterion validity could not be assessed with another NSP-specific questionnaire because no one was available at the beginning of the study, the NOSE test was taken as a reference.

The Spearman correlation coefficient (rho) was used to examine the correlation between SEPEQOL and NOSE total scores.[23] In addition, the SEPEQOL discrimination ability was evaluated using the receiver operating characteristic (ROC) curve and compared to the NOSE ROC curve using DeLong´s test. The optimal threshold value for both questionnaires was determined using the maximum Youden Index (J=sensitivity+specificity−1) [24, 25] and the sensitivity and specificity of both questionnaires were estimated.

Responsiveness was estimated using the paired T-Student test by comparing SEPEQOL total scores before and 6-months after surgery in 32 patients. The minimal clinically important difference (MCID) was calculated using distribution-based methods, including 0.5 Standard Deviation (SD=0.5*SD), Standard Error of Measurement (SEM=SD*sqrt 1- α), and Minimal Detectable Change (MDC=1.96*sqrt2*SEM).

Despite the lack of standardized values for HRQOL instrument validation [26–28] sample size calculations

for the SEPEQOL questionnaire were performed to ensure internal consistency, validity, and responsiveness. These calculations were based on Cronbach's α, concurrent and discriminant validity, and responsiveness measures [28, 29].

The required sample size for internal consistency was calculated assuming an expected Cronbach's α of 0.8 and an average inter-item correlation of 0.3[28]. For concurrent validity, a correlation coefficient of 0.5, a significance level of 0.05, and a power of 0.80 were used to assess the sample size. For discriminant validity, an expected mean difference of 10 points, an SD of 5 in both groups, a significance level of 0.05, and a power of 0.80 were utilized. To assess the responsiveness of the SEPEQOL, the required sample size was calculated using an effect size approach (Cohen's d) [29]. Based on these calculations, precision results can be achieved with samples of 50 patients, considering the possibility of losses.

The normality of the distribution of quantitative variables was assessed using the Shapiro-Wilk test. Frequencies and proportions were used for categorical variables; and means, median, and standard deviations were used for continuous variables. T-Student and U-Mann-Whitney were used to compare continuous variables depending on the normality of the distribution. Results with a *P-value*≤0.05 were considered statistically significant. Statistical analyses were performed using STATA v.16.1 (StataCorp, TX, USA).

Table 1 Demographic characteristics, aetiologies, and size data of the patients included in the study

Characteristics	Nasoseptal perforation (*N* = 96)	Healthy control (*N* = 30)	*P*-value
Demographic characteristics			
Age	50.0 ± 14.3	46.3 ± 14.2	0.891
Sex (female), N (%)	44 (45.83)	19 (63.3)	0.094
Causes of NSP			
Postsurgical	42 (46.8%)	-	-
Nasal picking	22 (22.9%)	-	-
Drugs	21 (21.9%)	-	-
Idiopathic	6 (6.3%)	-	-
Vasoconstrictive nasal spray	3 (3.1%)	-	-
Posttraumatic	2 (2.1%)	-	-
Location of NSP		-	-
Anterior	88 (91.7%)	-	-
Posterior	3 (3.1%)	-	-
Total/Subtotal	5 (5.2%)	-	-
Size of NSP		-	-
Size (Anterior-Posterior) mm	19.4 ± 8.9	-	-
Size (Superior-Inferior) mm	13.2 ± 5.7	-	-
Total area mm^2	292.2 ± 247.6	-	-

Mean ± standard deviation values were given. There were no significant differences in gender and age between patients with NSP and the control group (*P* > 0.05), as determined by Chi-squared and T-Student tests, respectively. Abbreviations: NSP, nasoseptal perforation

Cross-cultural adaptation

We performed a cross-cultural adaptation of the SEPEQOL survey according to recent guidelines [21, 30]. Two forward translations of the SEPEQOL from Spanish to English were made by native English-speakers. One translator was an ENT doctor, and the other had no medical background. The results of the translations were synthesised into a common translation and then a native Spanish-speaker without medical background realized a back translation from this target version. Ultimately, the expert committee produced a final version of the English SEPEQOL questionnaire (Fig. 1.)

Results

A total of 126 patients were included in the present study: 96 with NSP and 30 healthy volunteers. The mean ± standard deviation age was 49.11 ± 14.27 years, and 50% were female. No significant differences were found in the sample regarding age or sex. The most common causes of NSP were postoperative, nasal picking, and drug consumption. The median size of NSP was 212 (120.5–400) mm^2, and 91.67% (*N* = 88) were located anteriorly (Table 1). The mean SEPEQOL total score in patients with NSP was 25.16 ± 1.65, (Fig. 1 shows the breakdown of scores).

Reproducibility and reliability

Cronbach´s α was calculated for the items included in the NOSE questionnaire (1–4), and items from SEPEQOL were progressively added individually (5–12) of the NSP group as shown in Table 2. Cronbach´s α value of the SEPEQOL when only patients with NSP were included was 0.7843 [95% confidence interval (CI), 0.702–0.856], and 0.904 (95% CI, 0.875–0.933) when the whole sample was evaluated. Each item´s item-total correlation ranged from above 0.3 to less than 0.7.

Absolute and consistency ICC was 0.974 (95% CI, 0.935–0.989, *P-value* < 0.001) and 0.973 (95% CI, 0.935–0.989, *P-value* < 0.001) respectively, indicating an excellent correlation. Bland-Altman plot showed a minimum bias of 1.6 ± 4.57, 95% CI -0.54–3.74, with two outliers. There was a strong positive correlation between the test-retest SEPEQOL total score [r (95) = 0.914, *P-value* < 0.001] (Fig. 2).

Validity

The SEPEQOL mean score was significantly higher in NSP patients (24.46 ± 8.94) than in the control group (2.27 ± 2.12), indicating very good discriminant validity (*P-value* < 0.001) (Table 3). Criterion validity was rho (95) = 0.728, *P-value* < 0.001, demonstrating a high positive correlation between SEPEQOL and NOSE questionnaires total scores in patients with NSP.

Table 2 The internal consistency of SEPEQOL was assessed using Cronbach's α among patients with NSP

SEPEQOL questionnaire items	Cronbach´s α with deleted item	Item-total related (Pearson correlation)	Cronbach´s α with added item to the first four
1. Nasal congestion	0.7485	0.7083	0.776
2. Nasal blockage or obstruction	0.7645	0.5839	
3. Trouble sleeping	0.7654	0.5748	
4. Unable to get enough air through my nose during exercise	0.7662	0.5710	
5. Nasal crusting	0.7774	0.4753	0.705
6. Nose whistling	0.7587	0.6314	0.746
7. Nose bleeding	0.7835	0.4198	0.689
8. Headache or facial pain	0.7776	0.4727	0.702
9. Smell dysfunction	0.7737	0.5061	0.765
10. Thick nasal discharge	0.7544	0.6651	0.785
11. Need to blow my nose	0.7604	0.6158	0.792
12. Aesthetic changes in my nose	0.7947	0.3057	0.768
Total	**0.7843 (95% CI, 0.702–0.856)**	-	**-**

Cronbach´s α was calculated for the items included in the NOSE questionnaire (1–4) and progressively the items from SEPEQOL were included individually (5–12) to ensure internal consistency. Cronbach´s alpha value was 0.7843 (95% CI, 0.702–0.856). Abbreviations: SEPEQOL, Septal Perforation Quality of Life; NSP, nasoseptal perforation; CI, Confidence Interval

SEPEQOL questionnaire was also compared to the NOSE in terms of its ability to identify patients with NSP, using ROC curve analysis. SEPEQOL had an AUC of 0.998, while NOSE had an AUC of 0.981 (*P-value*=0.043) (Fig. 3).

The Youden Index threshold for SEPEQOL was determined to be 9. At this point, the sensitivity was 0.98 and the specificity was 1. On the other hand, the cut-off point for the NOSE questionnaire was established at 30, with a sensitivity and specificity of 0.89 and 1, respectively. According to the contingency tables, SEPEQOL had a sensitivity of 0.98 and a specificity of 1, while NOSE had a sensitivity and specificity of 0.90 (Fig. 4).

Responsiveness

SEPEQOL mean total score for the 32 patients with NSP who underwent surgery was higher before surgery (x=25.16±1.65) than 6-months after the procedure (x=13,72±11.39). T-test (T) for dependent samples showed a mean difference of 12.19±10.75 (T=6.41, *P-value*<0.001).

Minimal clinically important difference (MCID)

MCID was 5.38 using the 0.5*SD distribution method (0*5×10.76). A total of 25 patients (73.53%) experienced changes greater than this threshold. Using the SEM-based method [10.76*sqrt (1-0.78)], the MCID was 5.04, with 73.53% of patients reaching the cut-point. Finally, employing the MDC method (1.96*sqrt2*SEM), the MCID was 6.22, and 23 patients (67.65%) exceeded the threshold.

Discussion

SEPEQOL is an NSP-specific questionnaire with outstanding psychometric properties for assessing symptoms in Spanish-speaking patients in our sample. This questionnaire has demonstrated good internal

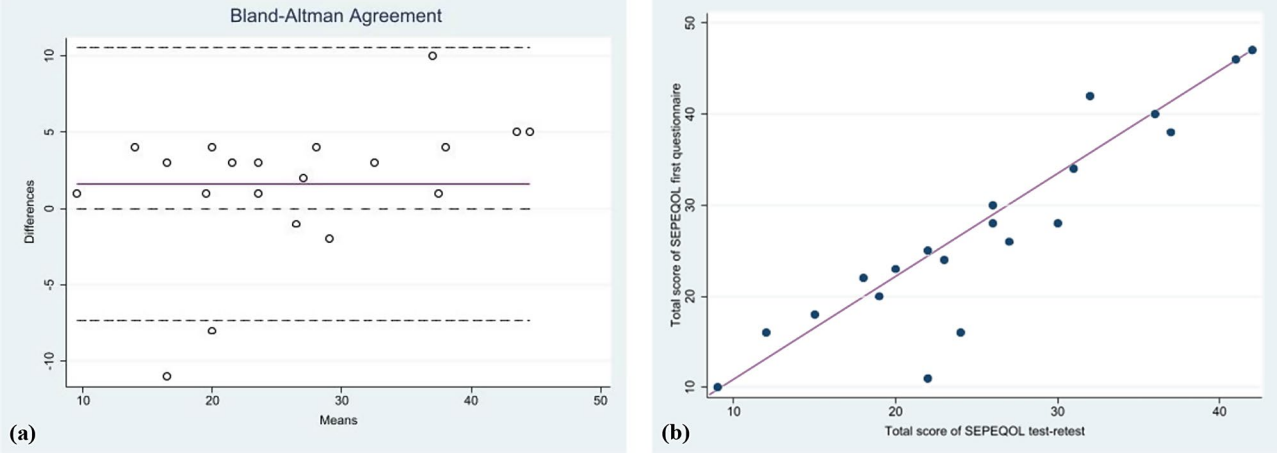
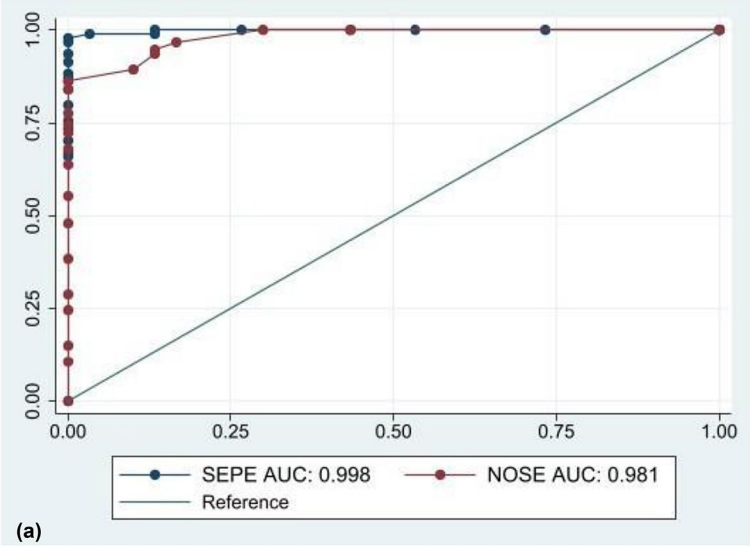


Fig. 2 Reproducibility assessment of SEPEQOL questionnaire. (**a**) The Bland-Altman plot illustrates the reproducibility of SEPEQOL in patients with NSP when tested again later. Reproducibility is better the closer the values obtained are to zero. The plot shows a narrow bias line close to zero with only two outliers, suggesting no significant changes with retesting. (**b**) The scatter diagram shows a strong positive correlation between SEPEQOL test-retest total scores. Pearson's correlation was used to calculate this parameter, (r) = 0.914, P-value < 0.001, indicating a strong positive association as it is close to 1

Table 3 HRQOL questionnaires total scores of patients with NSP compared to healthy controls

Questionnaires	Healthy controls (*N* = 30)	Patients with NSP (*N* = 96)	Total (*N* = 126)	95% CI on the difference between means
SEPEQOL (x ± SD)	2.27 ± 2.12	24.46 ± 8.94	19.09 ± 12.35	22.19 (18.92–25.46)
NOSE (x ± SD)	6.33 ± 9.91	65.68 ± 25.33	51.55 ± 33.97	59.34 (49.95–68.73)
SNOT-22 (x ± SD)	6.6 ± 5.99	47.58 ± 22.02	37.42 ± 26.23	40.98 (32.90–49.05)
Nasal Obstruction VAS (x ± SD)	6.33 ± 8.09	66.24 ± 27.81	52.00 ± 35.48	59.91 (49.70–70.11)
Rhinorrhea VAS (x ± SD)	6.00 ± 11.33	49.67 ± 34.47	39.27 ± 35.80	43.67 (30.97–56.36)
Smell Disorder VAS (x ± SD)	2.33 ± 5.68	34.48 ± 34.12	26.83 ± 32.89	32.15 (19.73–44.56)
Facial Pain/Pressure VAS (x ± SD)	0.67 ± 2.53	34.46 ± 31.84	26.41 ± 31.32	33.79 (22.24–45.34)
Nasal Whistling VAS (x ± SD)	3.00 ± 9.88	38.19 ± 33.96	29.81 ± 33.55	35.19 (22.72–47.65)
Nasal Crusting VAS (x ± SD)	3.33 ± 8.44	59.73 ± 35.91	46.30 ± 39.73	56.40 (43.27–69.52)
Nasal Bleeding VAS (x ± SD)	2.67 ± 9.07	34.36 ± 34.49	46.30 ± 39.72	31.70 (19.07–44.33)
				P-value **< 0.001**

The difference in the mean total score of the questionnaires was statistically significant between both groups (P-value < 0.001) as determined by the T-Student test. The mean score of the SEPEQOL was 24.46 ± 8.94 in the patient group compared to 2.27 ± 2.12 in the control group. Abbreviations: HRQOL: Health-Related Quality of Life; NSP: nasoseptal perforation; SEPEQOL: Septal Perforation Quality of Life; CI: Confidence Interval, VAS: visual analogue scale



NSP	SEPEQOL SCORE		
	≥9	< 9	Total
Yes	94 (100.00%)	2 (6.25%)	96 (77.19%)
No	0 (0.00%)	30 (93.75%)	30 (23.81%)
Total	94 (100.00%)	32 (100.00%)	126 (100.00%)

NSP	NOSE SCORE		
	≥30	< 30	Total
Yes	86 (96.63%)	10 (27.03%)	96 (77.19%)
No	3 (3.37%)	27 (72.97%)	30 (23.81%)
Total	89 (100.00%)	37 (100.00%)	126 (100.00%)

(b)

Fig. 3 The discriminant ability of the NOSE and SEPEQOL questionnaires between patients with NSP and healthy controls. (**a**) **ROC analysis** showed that AUC was 0.998 for SEPEQOL and 0.981 for NOSE, indicating excellent overall performance for both questionnaires. However, a comparison of the ROC curves showed that SEPEQOL had a better ability to discriminate than NOSE, with a P-value of 0.0426. (**b**) **Contingency tables of SEPEQOL and NOSE scores** at the optimal cut-off point calculated with the Youden index. The SEPEQOL contingency table, with a threshold of 9, displayed a sensitivity of 0.98 and a specificity of 1. On the other hand, the NOSE questionnaire contingency table, with a threshold of 30, showed a sensitivity and specificity of 0.9. Abbreviations: NOSE, Nasal Obstruction Symptom Evaluation; SEPEQOL, Septal Perforation Quality of Life; NSP, nasoseptal perforation; ROC, receiver operator characteristic; AUC, the area under the curve

consistency, high reliability, and strong validity. In addition, this instrument can detect changes over time with minimal burden.

The development of this questionnaire was prompted by the need to increase knowledge about NSPs[31]. Most studies have used the rate of NSP closure as the primary measure of treatment success[14]. Nevertheless, many patients experience improvement or even complete resolution of bothersome symptoms despite not completely closing the NSP. The information provided by PROMs can be critical in assessing surgical outcomes and help clinicians make decisions. Symptom resolution after NSP repair has not been well studied. The few papers reporting these results have used non-validated instruments for NSP, such as the NOSE and SNOT-22 questionnaires.=[7, 8, 14, 16, 17]. These scales have been validated for specific conditions, such as chronic rhinosinusitis, and specific symptoms like nasal obstruction. However, they do not include the cardinal symptoms of NSP such as epistaxis, whistling, crusting, and aesthetic changes [1, 4]. To date, the only validated questionnaire available for assessing patient symptoms related to NSP in English-speaking

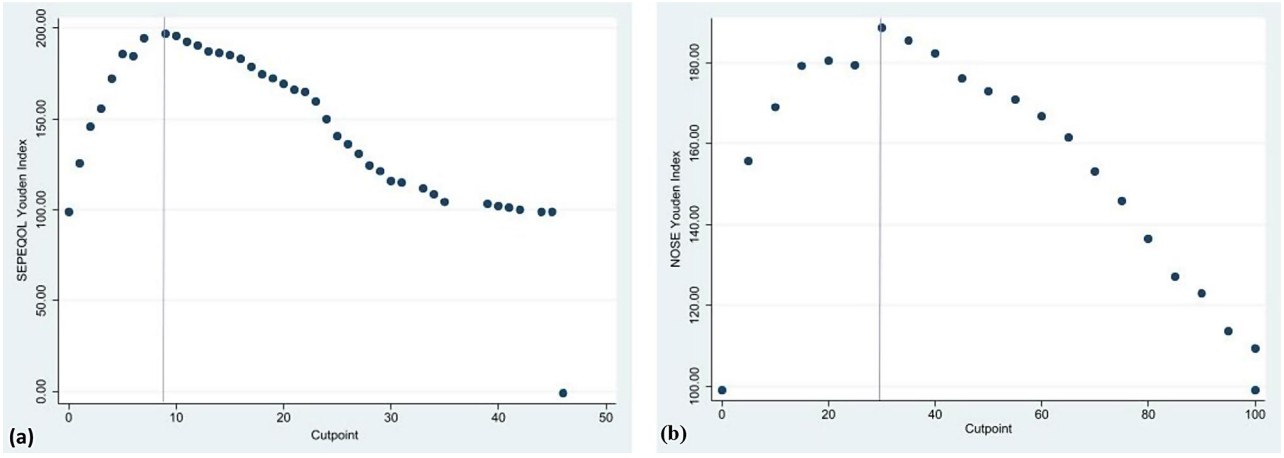


Fig. 4 The scatter plot represents the Youden Index for SEPEQOL and NOSE questionnaires. (a) SEPEQOL Youden Index. Youden index identifies the cut-off point that determines the highest sensitivity and specificity together. The purple line indicates the Youden Index threshold for SEPEQOL, established at 9 (S = 0.98, E = 1). (**b**) NOSE Youden Index. The cut-off for the NOSE questionnaire was 30 (purple line) according to the Youden Index (S = 0.89, E = 1). Abbreviations: SEPEQOL, Septal Perforation Quality of Life; NOSE, Nasal Obstruction Symptom Evaluation; S, sensitivity; E; specificity

patients, is the "NOSE-Perf Scale"[18]. Unfortunately, this scale was not accessible at the outset of our study in 2019, hindering its use as a benchmark. Nevertheless, both the SEPEQOL and NOSE-Perf Scale used the NOSE questionnaire as a gold standard because it has been the most widely used questionnaire in published studies [16, 17, 32].

The NOSE-Perf Scale includes 5/5 of the NOSE scale items. In contrast, SEPEQOL only incorporates 4/5 excluding "Trouble breathing through my nose". SEPEQOL also includes "Need to blow nose" and "Aesthetic changes in my nose", a specific symptom of large NSP. Experts recognize "Aesthetic changes in my nose" as a primary symptom significantly affecting patients' HRQOL. This is also supported by the authors of the NOSE-Perf Scale who acknowledge the importance of septal integrity in maintaining nasal dorsal support. However, it was not included in their instrument[33, 34].

In addition, some items were slightly different, such as "Foul or odd smell in my nose" and "Runny nose or post-nasal drip", which were replaced by "Decrease of smell" and "Thick nasal discharge" in the SEPEQOL questionnaire. Therefore, despite these subtle differences between items in both questionnaires, 9/12 items were shared. These similarities highlight a good, expected content validity of SEPEQOL.

The SEPEQOL questionnaire has shown adequate criterion validity and excellent discriminatory ability in distinguishing patients with NSP from healthy volunteers, despite not being the primary focus of the study. It has demonstrated better sensitivity and specificity than the NOSE scale. Additionally, the SEPEQOL´s construct and discriminant validity were satisfactory.

Furthermore, the SEPEQOL scale also showed good reliability. Internal consistency was excellent with a Cronbach's α of 0.90 for the entire sample and 0.78 for NSP patients. The item-total correlation confirmed an adequate correlation for each item. As a result, no item was excluded. These results confirm that the measurement precision and consistency of the instrument were satisfactory. Unlike most validation studies of HRQOL questionnaires (including the NOSE-Perf Scale) [18] do not specify how they calculate internal consistency, our study addresses this issue. Including healthy volunteers in such studies can obtain higher internal consistency scores, as their asymptomatic status ensures stable outcomes. To avoid this bias, we provide a detailed explanation of the method used to calculate Cronbach´s α.

The reproducibility of the present instrument, assessed with the test-retest method, confirmed its excellent reproducibility, comparable to the NOSE-Perf Scale [18]. Bland-Altman plot showed a significant correlation and agreement between test-retest, and ICC values were consistent.

SEPEQOL validation includes the study of responsiveness to change to assess the impact on HRQOL after clinical or surgical intervention. The preoperative score significantly decreased from 25.16 to 13.72, 6-months postoperative in 32 patients (*P-value* < 0.001). The NOSE-Perf validation study did not originally assess responsiveness [18]. However, Bansberg et al. later confirmed its responsiveness by demonstrating that the NOSE-Perf total score decreased from 26.4 (95% CI, 5.2) to 14.5 (95% CI, 5.2) postoperative (*P-value* < 0.0001). Despite this, they do not specify the period when the second questionnaire was administered [33].

Furthermore, in the validation paper of the NOSE-Perf for Spanish-speaking patients, [19] the authors did not study this psychometric characteristic. As a result, it can only assess HRQOL at a single point in time and

is not available to evaluate postoperative changes, losing valuable follow-up information [21]. Thus, the main advantage of the SEPEQOL is that it is the only validated questionnaire in Spanish that assesses the responsiveness to change, which is an important factor in assessing postoperative outcomes.

It is worth noting that statistical significance in changes in HRQOL scores does not necessarily determine a clinically relevant change [35]. Hence, the MCID is necessary and it was calculated using different distribution methods: 0.5*SD, SEM, and MDC, which yielded values of 5.38, 5.04, and 6.22, respectively. Using the first two methods, 73.53% of patients improved above the threshold, establishing 5.38 as MCID. These measurements were calculated 6-months after surgery, as this timeframe allows for the resolution of postsurgical inflammation, resulting in more stable outcomes as confirmed by Taylor CM et al. [36].

Moreover, the respondent and administrative burden of the SEPEQOL were acceptable. The questionnaire was completed at the end of the consultation and did not require any special requirements, excessive time, or effort.

SEPEQOL is a useful tool for rhinologists to evaluate clinical and treatment outcomes in Spanish-speaking patients with NSP. The authors of the study highlight the need for an English version of SEPEQOL, since English is the most widely spoken language worldwide [37] and SEPEQOL has suitable psychometric properties, including the responsiveness to change. The cross-cultural adaptation of the questionnaire arose from the need to compare results across different populations. This process requires more than simple translation; it demands semantic equivalence and is difficult to achieve and evaluate. Consensus guidelines for cross-cultural adaptation aim to maximize the achievement of semantic, idiomatic, experiential, and conceptual equivalence between the source and target questionnaires [21, 30]. following these guidelines. Nonetheless, an additional study is required to validate this novel questionnaire in the target population to ensure comparable results among different populations.

The present study has some limitations that need to be considered. One is possibly related to the selection of patients. The sample may have been biased towards including mostly symptomatic patients, as they require more resources and frequent consultations.

We faced difficulty in estimating concurrent validity for SEPEQOL due to the lack of a reliable gold standard. The only HRQOL instrument for English-speaking patients with NSP is the NOSE-Perf Scale, published in 2021. Certainly, both questionnaires have limitations in their designs due to the lack of assessment of patients' functionality and emotionality, and there is not enough evidence to conclude when to use each questionnaire in different clinical scenarios. The SEPEQOL questionnaire has been validated in an NSP population, most of whom required surgical treatment and experienced moderately to severe symptoms, similar to the NOSE-Perf questionnaire. However, the validation of NOSE-Perf did not specify the causes of the NSP. Therefore, we cannot determine which questionnaire is better based on the causes of NSP.

Additionally, relying solely on distribution-based methods to calculate MCID has several limitations. These methods are influenced by sample size and variability, disregard patient-reported outcomes, and may lack clinical relevance [35]. Future studies that combine distribution-based and anchor-based methods can provide a more accurate and clinically relevant MCID.

Despite these limitations, the authors do not believe that these affect the psychometric results obtained in the study.

Conclusion

SEPEQOL is an NSP-specific questionnaire with outstanding psychometric characteristics in the population studied. The questionnaire has demonstrated good internal consistency, very high reliability, robust validity, and the ability to detect changes over time. It is easy to use in clinical settings and the burden on respondents is reasonable. The SEPEQOL scale can be used to investigate the HRQOL in Spanish-speaking patients with NSP to obtain objective results that can be used to guide clinical practice and select the most appropriate treatment.

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Author contributions
BAF: data collection, carried out the statistical analysis, wrote the main manuscript, and prepared figures and tables.ASG: designed the questionnaire, data collection, and reviewed the manuscript.FMS: designed the questionnaire, data collection, and reviewed the manuscript.MJRL: data collection and carried out the statistical analysis.IA: designed the questionnaire, data collection, and reviewed the manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethical approval
The study was approved by the Ethics Committee of Ramón y Cajal Hospital (PERFOSEPTO.1) and Clinic Hospital (HCB/2021/0170).

Consent for publication
All authors of the study consent to its publication.

Competing interests
The authors declare no competing interests.

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