

Quality of life after nasal cancer resection – surgical versus prosthetic rehabilitation*

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Background: Nose reconstruction following resection of nasal carcinomas is controversial. The objective of this study is to investigate the effect of surgical reconstruction versus prosthetic rehabilitation on patient quality of life (QOL).

Design: This was a monocentric prospective study of patients diagnosed with nasal carcinoma from 2003 to 2013. QOL was evaluated using two organ-specific questionnaires (Rhinoplasty Outcome Evaluation [ROE] and the Functional Rhinoplasty Outcome Inventory-17 [FROI-17]) and a generic questionnaire, the Short-Form 36 Health Survey (SF-36).

Material and Methods: Sixty-four patients were included. Patients completed the ROE, FROI-17, and SF-36 questionnaires after nasal reconstruction. Questionnaires were completed by 62.8% of the 51 alive patients.

Results: Recurrence-free survival (RFS) was 89.9%, disease-specific survival was 94.5%, and overall survival was 75.5% after five years according to the Kaplan-Meier method. Considering initial tumor stage, early stage patients had a significantly higher self-confidence score in FROI-17 subgroup analysis. In contrast, advanced stage patients showed a significantly higher score for social functioning in SF-36. Prosthetically fitted patients scored highly on the ROE questionnaire showing a high degree of aesthetic satisfaction. Surgically reconstructed patients showed a high degree of self-confidence on the FROI-17 questionnaire. However, the organ-specific ROE and FROI-17 scores were not significantly different between patients who received surgical reconstruction and prosthetic rehabilitation after oncological resection. When comparing the rehabilitation method as a function of tumor stage, there was significantly better score for "physical functioning" in early stage surgically reconstructed patients in the SF-36, but no significant differences in organ-specific QOL.

Conclusion: Surgical reconstruction and prosthetic rehabilitation after nasal cancer resection have the same effect on organ- and non-organ-specific QOL.

Key words: nasal neoplasm, reconstruction, Quality of life, SF-36, ROE, FROI-17

Introduction

Optimal oncological outcome is important following surgical resection of carcinomas from the inner or outer nose. In addition, functional and aesthetic restoration of the nose is also important to the surgeon and particularly to the patient⁽¹⁾. Health-related quality of life (HRQOL) is becoming increasingly important, therefore measuring the clinical outcome during postoperative evaluation is imperative.

Several studies have shown short- and long-term changes in patient quality of life (QOL) after septorhinoplasty. However,

little is known about the HRQOL of nasal cancer patients after an external rhinoplasty approach, such as lateral rhinotomy, partial rhinectomy, or total rhinectomy. We expected patients to have a higher QOL score after surgical reconstruction (SR) than patients with prosthetic rehabilitation (PR). Figure 1 illustrates two patients who underwent partial rhinectomy with one being prosthetically rehabilitated, and the other one surgically reconstructed. To measure health outcomes and HRQOL in patients after tumor-related resection followed by reconstruction of the nose, we used two validated organ-specific questionnaires: the

Functional Rhinoplasty Outcome Inventory-17 (FROI-17) and the Rhinoplasty Outcome Evaluation (ROE) ^(2, 3). To our knowledge, this is the first and largest study to analyze and compare patients' functional and aesthetic satisfaction after SR versus PR of the nose based on generic and organ-specific Patient Reported Outcomes Measures (PROMS).

Materials and methods

Ethical approval and informed consent

Ethical permission was granted from the local ethics committee according to the Declaration of Helsinki on biomedical research involving human subjects (Project No. S-116/2012). Informed consent was obtained from all patients.

Surgery

Patients who underwent primary surgical removal of a malignant tumor from the nose at the Department of Otolaryngology, Head and Neck Surgery at the University Hospital Heidelberg from 2003 to 2013 were included in this study. According to National Comprehensive Cancer Network guidelines, surgical resection was the preferred treatment option. Surgery was performed with an external approach. A lateral/partial or total rhinectomy was performed depending on tumor entity and localization (skin or nasal vestibule). For all patients, clinical and follow-up data (sex, age, TNM classification, histopathological differentiation, treatment modalities, and outcome) were recorded. Tumors were staged according to the UICC (7th edition) for nasal cancer or skin cancer as applicable. Recurrence-free survival (RFS), overall survival (OS), and disease-specific survival (DSS) were estimated by the Kaplan-Meier method.

Questionnaires

All patients completed two organ-specific questionnaires (FROI-17 and ROE) and one generic questionnaire (SF-36) after surgery and restoration of the nose. Questionnaires were completed during an outpatient visit or via mail between February 2013 and April 2015.

The ROE contains six items; five measure aesthetic aspects and one measures the functional outcome of septorhinoplasty ⁽⁴⁾. Each response is graded between zero (worst) and four (best) and the sums of the item scores are then converted into percentages. A higher ROE score indicates higher satisfaction. The FROI-17 is also an organ-specific questionnaire and measures more functional aspects ⁽⁵⁾. It contains 17 items graded from zero (no problem) to five (worst problem) and is then transformed to a 0–100 percentage scale by dividing the sum of the raw item scores by the sum of ranges then multiplying by 100. A higher FROI-17 score indicates less satisfaction. The SF-36 Health Survey is divided into eight groups: physical functioning, role-functioning physical, physical pain, general health, vitality, social functioning, role-functioning emotional and mental health.

Table 1. Clinicopathological characteristics, surgical characteristics, and questionnaire response statistics of the study population

Characteristic	Entire cohort (n=64)	Prosthesis cohort (PR) (n=27)	Reconstruction cohort (SR) (n=37)
Mean age (range)	64 (38–93)	67 (38–92)	63 (41–93)
Gender -			
Male	42 (65.6%)	16 (59.3%)	26 (70.3%)
Female	22 (34.4%)	11 (40.7%)	11 (29.7%)
Histology			
BCC	20 (31.3%)	5 (18.5%)	15 (40.5%)
Merkel cell carcinoma	1 (1.6%)	0 (0%)	1 (2.7%)
Mucoepidermoid carcinoma	1 (1.6%)	1 (3.7%)	0 (0%)
SCC of nasal cavity	36 (56.3%)	18 (66.7%)	18 (48.6%)
SCC of skin	6 (9.4%)	3 (11.1%)	3 (8.1%)
T stage			
T1/T2	39 (60.9%)	8 (29.6%)	31 (83.8%)
T3/T4	25 (39.1%)	19 (70.4%)	6 (16.2%)
N stage			
N0	59 (92.2%)	24 (88.9%)	35 (94.6%)
N+	5 (7.8%)	3 (11.1%)	2 (5.4%)
M stage			
M0	62 (96.9%)	25 (92.6%)	37 (100%)
M1	2 (3.1%)	2 (7.4%)	
Questionnaire (FROI-17, ROE, and SF-36)			
No response			
Response	19 (29.7%)	6 (22.2%)	13 (35.1%)
Excluded because of death	32 (50%)	11 (40.7%)	21 (56.8%)
	13 (20.3%)	10 (37%)	3 (8.1%)
Time of observation (years)	4.6 (0.4–12.8)	4.5 (0.4–12.8)	4.6 (0.42–12.3)
5-year overall survival rate	75.5%	62.4%	85.2%
5-year disease-specific survival rate	94.5%	86.9%	100%
5-year recurrence-free survival rate	89.9%	83.3%	95%

BCC, basal cell carcinoma; SCC, squamous cell carcinoma; n = number of patients

Information about scales and item-scoring can be found in the SF-36 Health Survey Manual and Interpretation Guide.

Statistics

The postoperative FROI-17, ROE, and SF-36 scores were calculated and statistical analysis was performed using IBM SPSS Statistics software (version 22). Differences between groups were evaluated by log rank, Levene's, and t-tests. In all statistical tests, a p-value of 0.05 or below was considered statistically significant.

Results

Sixty-four patients with a primary carcinoma of the inner or ou-

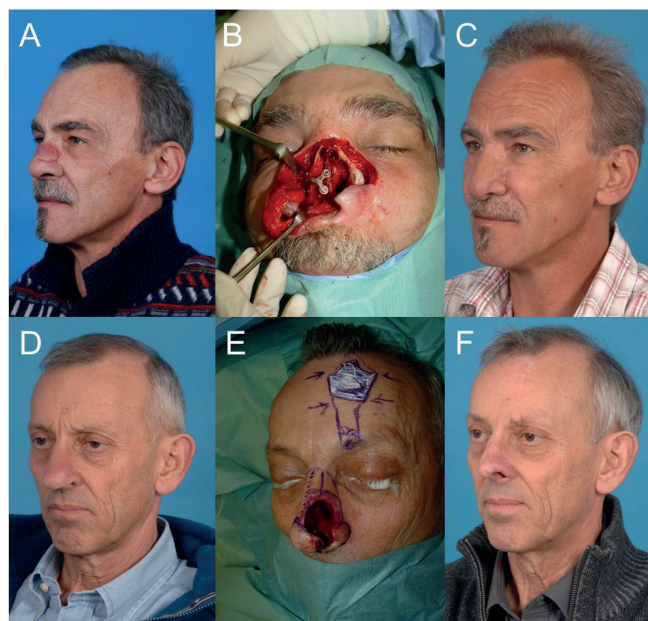


Figure 1. (A-C) – Rehabilitation by an implant-retained nasal prosthesis: (A) preoperative photo shows tumor infiltration of the skin, incision for deep biopsy performed elsewhere; (B) implant position (nasal plate of the Epiplating® System by Medicon eG Tuttlingen, Germany) after subtotal rhinectomy; (C) patient with fitted prosthesis (anaplastologist Mathias Schneider, Zweibrücken, Germany); (D-F) – three-layered surgical reconstruction by a paramedian forehead-flap in Menick's technique and cartilage graft: (D) preoperative photo shows nasal deformity by subcutaneous tumor growth spreading from the nasal cavity, (E) partial rhinectomy with reconstructive procedure; (F) patient 12 months after reconstruction.

ter nose were included in the analysis. Baseline patient characteristics are presented in Table 1. Patient age ranged from 38 to 93 years and the mean age was 64 years. The gender ratio was 1.9 in favor of men (22 women and 42 men). Twenty out of 64 patients had a basal cell carcinoma (31.3%), 36/64 had a squamous cell carcinoma (SCC) of the nasal cavity (56.3%), and 6/64 had a SCC of the nasal skin (9.4%). Two patients had different tumors (3.2%). Depending on their extension, tumors were excised via lateral rhinotomy, partial rhinectomy, or total rhinectomy. Twenty-seven patients with more extensive resection (subtotal or total ablation) were fitted with an implant-retained nasal prosthesis. In 37 patients with a partial nose resection, the nose was aesthetically reconstructed using a forehead flap (Figure 1). The median follow-up time was 4.5 years (range 0.3–12.8 years) with regular clinical examinations. Different subgroup analysis was performed comparing patients either treated with SR or PR as well as SR vs PR in early stage and SR vs PR in advanced stage subgroups. The 5-year OS was statistically significant between the two groups (62.4% for the PR cohort and 85.2% for the SR cohort; log rank $p=0.03$). Furthermore, the 5-year DSS was significantly lower in PR patients than SR patients (PR 86.9%,

SR 100%; log rank $p=0.04$). There was no significant difference in RFS between the two groups (PR 83.3%, SR 95%; log rank $p=0.16$).

At the time of HRQOL data collection, 51/64 patients (79.7%) were still alive. Thirty-two (62.8%) living patients completed all questionnaires; 11 were PR patients (34.4%) and 21 were SR patients (65.6%). The average time point for completing the HRQOL questionnaire was 2.4 years after surgical intervention (range 0.2–8.8 years). The mean and standard deviation values for all questionnaires are presented in Table 2. T-test revealed no significant differences in variance of FROI-17 and ROE responses between SR and PR groups (Table 2). ROE scores revealed a higher HRQOL in PR patients, but the difference was not statistically significant. In addition, the FROI-17 self-confidence subscale had very few outliers and clustered in very low values for SR patients, indicating a high degree of self-confidence. However, none of the FROI-17 scales (overall score, nasal symptoms, general symptoms, and self-confidence, (Figure 2)) were significantly different between SR and PR groups. Similarly, there were no significant differences in SF-36 questionnaire scores between the two groups (Table 2). A tendency towards better vitality ($p=0.066$) and mental health was observed in SR patients ($p=0.069$) (Table 2).

The median and quartiles for ROE and FROI-17 subscales after SR and PR are illustrated by boxplots in Figure 2, respectively. Comparing early stage (T1/T2) or advanced stage (T3/T4) nasal cancer patients depending of their reconstruction (SR or PR), no significant difference was seen in the FROI-17 and ROE questionnaire evaluation. In the T1/T2 stage group the SF-36 "physical functioning" ($p=0.037$) was significantly better for the SR than for the PR patients. T-test was also $p < 0.05$ for "vitality" and for "mental health" with much better outcome for the SR group. However, the PR subpopulation cohort in early cancer was very small, so the Levene test for variance equality could not be performed. Because of this, these values are only approximate and should be disregarded. In the SF-36 for advanced stage SR vs PR patients, no significant difference was observed.

Discussion

Measuring HRQOL has become more and more important in clinical medicine, especially for internal medicine and oncology. Several questionnaires, such as the SF-36, have been widely used to evaluate HRQOL. Evaluating the functional and aesthetic satisfaction of a patient after nose surgery is a growing challenge⁽⁶⁾. For conventional rhinoplasty interventions, the only HRQOL questionnaires that have been evaluated so far are the ROE and the FROI-17^(2,6). Different studies have shown improved postoperative FROI-17 and ROE scores after conventional rhinoplasty^(5,7,8). However, to our knowledge, only two articles have described postoperative HRQOL after radical nasal tumor

Table 2: FROI-17, ROE, and SF-36 scales after prosthetic rehabilitation (PR) versus surgical reconstruction (SR) in general (T1-T4), in early stage patients (T1-T2) and SR vs PR in advanced stage patients (T3-T4).

Questionnaire	T-Stage	Prosthetic rehabilitation		Surgical reconstruction		p-value (SR vs PR)
		Mean	SD	Mean	SD	
FROI-17						
Overall score	All	18.7	10.2	21.4	20.7	0.737
	T1-T2	22.5	10.6	15.3	13.6	0.490
	T3-T4	17.5	10.8	41.3	29.4	0.102
Nasal symptoms	All	20.0	12.4	21.6	17.9	0.818
	T1-T2	26.7	23.6	16.9	13.2	0.386
	T3-T4	18.1	9.8	36.7	25.1	0.238
General symptoms	All	16.6	14.4	19.6	21.8	0.725
	T1-T2	20.0	0.0	14.8	16.1	0.267
	T3-T4	15.4	16.8	32.0	31.5	0.292
Self confidence	All	17.5	21.8	12.7	24.4	0.644
	T1-T2	15.0	21.2	5.3	8.8	0.240
	T3-T4	18.3	24.0	32.0	40.9	0.506
ROE						
	All	75.9	13.5	72.1	23.8	0.657
	T1-T2	83.3	5.9	78.1	16.6	0.669
	T3-T4	73.8	14.6	54.2	34.9	0.205
SF-36						
Physical functioning	All	61.8	33.8	74.3	28.9	0.282
	T1-T2	27.5	3.5	75.3	29.0	0.037
	T3-T4	69.4	32.6	71.0	31.5	0.933
Role-functioning physical	All	65.0	47.4	61.3	48.9	0.843
	T1-T2	50.0	70.7	61.7	49.0	0.764
	T3-T4	68.8	45.8	60.0	54.8	0.761
Bodily pain	All	81.1	27.7	78.3	26.9	0.790
	T1-T2	83.3	23.6	80.6	26.4	0.890
	T3-T4	80.6	30.1	71.1	30.0	0.593
General health	All	49.5	11.7	65.0	26.9	0.096
	T1-T2	40.0	14.1	68.2	26.1	0.164
	T3-T4	51.9	10.7	56.0	30.3	0.726
Vitality	All	45.6	20.8	64.0	25.2	0.066
	T1-T2	10.0	0.0	66.3	22.6	0.030*
	T3-T4	50.0	17.1	57.0	33.9	0.627
Social functioning	All	47.2	5.5	47.5	9.6	0.936
	T1-T2	37.5	0.0	46.7	11.0	0.272
	T3-T4	50.0	0.0	50.0	0.0	-
Role-functioning Emotional	All	50.0	45.1	70.2	45.7	0.266
	T1-T2	16.7	23.6	73.8	43.7	0.098
	T3-T4	58.3	46.3	60.0	54.8	0.954
Mental health	All	60.0	11.7	69.4	12.7	0.069
	T1-T2	32.0	0.0	72.5	8.4	0.000*
	T3-T4	63.5	5.4	60.0	19.2	0.709

*Due to small number of patients cohort Levene test for variance equality could not be performed. p-values should be disregarded. A higher ROE score indicates higher satisfaction. A higher FROI-17 score indicates lower satisfaction.

resection and these studies only included patients with nasal prostheses^(9,10). In these studies, the postoperative outcome was evaluated using a modified Nasal Appearance and Function Evaluation Questionnaire (NAFEQ) and the University of Washington QOL (UWQOL) questionnaire⁽¹¹⁻¹³⁾. The UWQOL mainly measures physical and social function, such as pain, appearance,

activity, recreation, swallowing, chewing, speech, shoulder function, taste, saliva, mood, and anxiety. The ROE primarily evaluates cosmetic outcome and the organ-specific FROI-17 considers both functional and aesthetic outcomes after rhinoplasty. In this study, we used the ROE, FROI-17, and SF-36 questionnaires for the first time to compare the QOL of nasal carcinoma patients

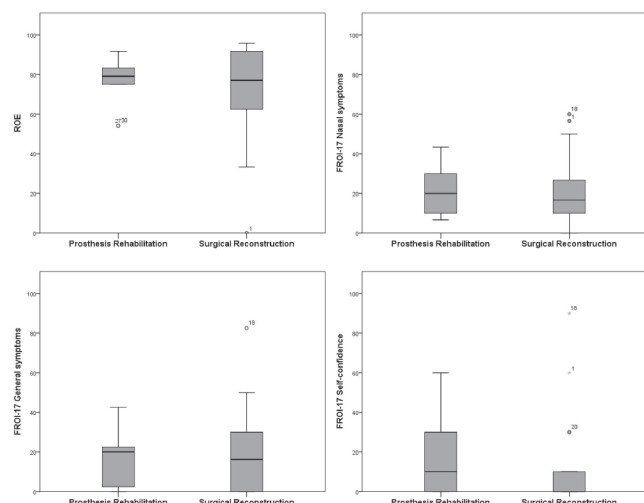


Figure 2. Box-plot analysis showing ROE and FROI-17 sub scores. A higher ROE score indicates higher satisfaction. A higher FROI-17 score indicates lower satisfaction.

after SR and PR.

We evaluated the satisfaction of 64 patients who underwent primary surgical resection of malignant tumors from the outer nose area or nasal cavity. Referral bias was minimized because the primary treatment in our institution is surgery rather than radiotherapy. Most studies measuring patient satisfaction after conventional rhinoplasty have shown a mean ROE score of 58.8–83.3 (6, 8, 14, 15). A higher ROE score indicates higher satisfaction. Low-level scores can most likely be attributed to revision rhinoplasty operations or different mean follow-up periods (between 5 and 60 months) (16). The mean follow-up period of PR and SR groups was 2.4 years in this study. This follow-up period is within the range of those reported in the literature. The ROE score was 75.9 in the PR group and 72.1 in the SR group, indicating that the postoperative aesthetic QOL satisfaction was similar in both groups. In the subgroup analysis (early stage vs. advanced stage) QOL outcome was similar for the early stage PR and SR group as well as the advanced stage PR group. Although not significant, the patients in the advanced stage SR group performed worse (ROE score only 54.2). The findings of the whole PR or SR group were similar to ROE scores following conventional rhinoplasty measured previously in our institution (1-year ROE score 68.5, 5-year ROI score 75.1) (16, 17). Although we did not observe statistically significant differences between the groups, it is interesting to note that the ROE scores of PR patients clustered in the very high range and that the aesthetic perception for advanced stage SR patients is reduced. This could indicate a high degree of resilience after PR. Even though conventional rhinoplasty for nasal deformity and tumor-related nasal surgery are difficult to compare, it is interesting that two different patient groups have similar scores for aesthetic satisfaction.

The ROE questionnaire mainly evaluates aesthetic outcomes after rhinoplasty surgery, while the FROI-17 measures both aesthetic and functional outcomes. Unlike the ROE, a higher FROI-17 score indicates lower satisfaction. The overall FROI-17 scores were not significantly different between the PR and the SR group and both groups were similarly satisfied with “nasal and general symptoms” and “self-confidence.” Sub scores for “self-confidence” were lower in the SR group than the PR group (Figure 2). This reflects the excellent cosmetic outcome of SR. The FROI-17 scores for both groups were similar to conventional 1-year rhinoplasty outcomes previously reported by our own institution (overall score 20.2, nasal symptoms 21.5, general symptoms 20.0, and self-confidence 16.9) (Table 2) (16). Some studies have shown lower satisfaction after aesthetic rhinoplasty compared with other types of aesthetic surgery, such as breast augmentation, blepharoplasty, and lipoplasty (18–20). In this study, FROI-17 scores showed surprisingly high patient satisfaction levels following disfiguring tumor surgery of the nose that was reconstructed by PR or SR. We hypothesized that SR patients would be more satisfied than PR patients, but the ROE and FROI-17 scores were similar in both patient groups. Although not significant, it is interesting to see that advanced stage SR patients did also show (similarly to the outcome of the ROE) more dissatisfaction in the whole FROI-17 questionnaire compared to all other groups. FROI-17 and ROE show a trend towards reduced QOL in advanced stage SR patients. However, none of the reconstructed patients asked to change to a prosthetic rehabilitation.

Increased SF-36 subscores have been reported after rhinoplasty (17, 21). In our cohort, PR and SR patient groups had positive scores for “physical functioning,” “role-functioning physical,” “bodily pain,” and “mental health” after intervention. A negative/neutral “role-functioning emotional” score was found for the scales “general health,” “vitality,” and “social functioning,” in the PR group. In contrast, only one negative score for “social functioning” was found in the SR group. Although the scores were not significantly different between patient groups, a trend for higher satisfaction in “vitality” and “mental health” was seen in the SR group. In our opinion, the correlation of positive and negative scales between groups (3/8 negative for the PR group and 1/8 negative for the SR group) may be related to the patients’ preoperative mental and physical state; patients in a poorer state of health were more likely to decline complex reconstructions and opt for prosthetic restoration of their nose. The SF-36 scores of our cohort were moderate compared with reported scores after rhinoplasty. The reason for this could be the advanced age of our nasal tumor patients (mean age 64 years) compared with the predominantly younger age of patients undergoing rhinoplasty (mean age 29 years) (16). Patient satisfaction after nasal reconstruction following tumor resection has not been well reported. However, while there was no significant difference in PR to SR

group analysis of SF-36, subgroup analysis of SR vs PR patients, depending on their tumor stage (T1/T2 respectively T3/T4) did show a better outcome for the SF-36 “physical functioning” in the early stage reconstructed patients. Within the T1/T2 group, there was a low sub score of 27.5 for the PR and high score with 75.3 for the SR group.

To our knowledge, this is the first study to examine QOL using two organ-specific and one general questionnaire in patients who underwent SR versus PR after oncological resection of the nose. Our findings suggest that more than one questionnaire is necessary to evaluate functional and aesthetic aspects after nasal surgery as well as the patient QOL.

Conclusion

A nasal prosthesis or surgical reconstruction are both reliable options following partial or total rhinectomy. ROE scores were high in patients who received a nasal prosthesis indicating a high degree of aesthetic satisfaction. Surgically reconstructed patients had low FROI-17 scores showing a high degree of self-confidence. However, the differences between organ-specific ROE and FROI-17 questionnaires were not statistically significant between the surgically reconstructed and the prosthetically rehabilitated groups. Considering initial tumor stage, advanced stage surgically reconstructed patients had a non-significant trend to a worse outcome in the FROI-17 and ROE analysis than all other groups. In contrast, early stage SR patients showed a significantly higher score for physical functioning in SF-36 than the equivalent PR group. Interestingly, our nasal cancer surgery

cohort has similar QOL scores as conventional rhinoplasty patients previously treated in our own institution. This implies that surgical reconstruction and nasal prostheses following tumor resection have equally successful functional and aesthetic outcomes and a positive impact on patients' QOL.

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Authorship contribution

All authors made substantial contributions to the study.

KZ: designed and coordinated the study, participated in data acquisition and analysis, interpreted the data and drafted the manuscript. HMT: participated in data acquisition and analysis, critically revised the manuscript for important intellectual content. MP: participated in statistical data analysis, critically revised the manuscript for important intellectual content. IB: participated in data interpretation and revision of the manuscript. PKP: participated in data analysis, critically revised the manuscript for important intellectual content. PAF: designed and coordinated the study, participated in data acquisition and analysis, interpreted the data, critically revised the manuscript for important intellectual content.

Conflict of interest

All authors declare that they have no conflict of interest.

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