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Covid-19 and Obstructive Sleep Apnea: The Theatricals and Quality-of-Life Impact

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Abstract COVID-19 caused by SARS-CoV2 has reached pandemic proportions. The fear of Covid-19 has deterred many to abandon efforts for seeking timely medical help. In this setting, Obstructive sleep apnea (OSA)-like covid/non-covid cohorts have presented. Atypical pathologies can present like OSA and take the clinician unawares. With this series of misfits suffering silently, it would be unwise to underestimate its impact on quality-of-life (QOL). To determine the effect on quality-of-life by pathologies mimicking OSA and assess Covid-19 as a cause for delayed presentation. This was a prospective cross-sectional study. 127(N). Recent onset of symptoms of OSA. Study duration March 2020 to September 2021. Pittsburgh Sleep Quality Index (PSQI) screening done. Study criteria defined. Sleep parameters calculated. Primary surgical intervention given. Non-responders were put on CPAP therapy. QOL assessment done with sf-36 and SAQLI. Fear of Covid-19 scale (FCV-19S) quantified to study cause for temporal delay. Correlations computed. Level of Evidence—Level 3. 97 candidates completed study. Demographic and anthropometric details noted. Mean range was 43.85 ± 11.39 years. Male predominance. Overall AHI-19.73 ± 8.72. Moderate impact on QOL by sf-36/SAQLI. 78n Primary surgical candidates fared well. Polysomnography (PSG) and Continuous positive airway pressure (CPAP) titration/trial characteristics for 19n available. Statistically significant improvement in QOL after treatment completion. Correlations were meaningful. Body Mass Index (BMI) as a single factor was not influential on OSA-mimickers. Fear of Covid-19 significantly impacted emergency medical aid acquisition. OSA mimicking atypical airway pathologies may need emergent treatment not only from a surgical point-of-view but also from the QOL of the patient. On the contrary, these also unmask subclinical OSA, especially in patients with low/normal BMI. This category of recent onset OSA, if fortunately picked up at the earliest possible presentation, may hopefully not go through the significant QOL impact suffered by chronic OSA candidates.

Introduction

COVID-19 caused by SARS-CoV2 originated from Wuhan city in China in November 2019 soon reached pandemic proportions [1, 2]. The 2 waves have humbled both the nation and the world in terms of acute scarcity of medical supplies and loss of lives [3]. Many patients presented with sore throat, high fever, dry cough, breathing problems, decreased smell and taste sensation and easy fatigability [4]. A variety of both covid and non-covid atypical pathologies have presented as crops/clusters since the start of Covid-19 pandemic [5, 6] with symptomatology masking primary disease. This study helped to determine the importance of establishing clinical suspicion of overt pathologies in selected cases which masquerade as Obstructive sleep apnea (OSA) [7, 8]. OSA has emerged as a global disease with causes being multi-factorial [9] with varied presentations [10–13]. Different modalities of treatment have been advocated [14, 15].

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PubMed/Medline search on articles citing OSA mimickers collected [16–18]. Apart from case reports and a few neurological case series, large volume studies of ENT conditions presented with a façade of OSA were unavailable. By avoiding medical care due to fear of Covid-19, the effects of recent onset OSA and its impact on the quality-of-life were dramatic.

Aim

To determine the effect on quality-of-life by pathologies mimicking OSA in the Covid-19 pandemic setting and assess Covid-19 as a cause for delayed presentation.

Materials and Methods

This was a retrospective and prospective cross-sectional study conducted on 127(N) patients referred to the department of otorhinolaryngology with primary complaints of recent onset of symptoms of snoring and disturbed sleep at night, either by self or by partner. Duration of study period was from March 2020 to September 2021. Thorough ENT examination was done including endoscopies. Candidates with static airway obstruction were selected. OSA symptomatology noted. Some of the presenting pathologies were deep seated with minimal external presentation. On probing, some of the candidates recollected previous single/occasional fever spikes/pain/difficulty in swallowing or breathing for which they either took over-the-counter/self-medications/neglected due to fear of Covid-19 thereby procrastinating timely intervention.

Institutional Ethical Committee and Review Board clearance was obtained. Written informed consent was obtained. All candidates underwent Covid-19 RT-PCR testing [19, 20]. Full Personal protective equipment (PPE) were donned for all procedures. Proper doffing was followed. All patients were in separate rooms as a precaution to prevent any cross-contamination. The subjects acted as their own controls.

Candidates screened with Pittsburgh Sleep Quality Index (PSQI) [21] for OSA. A level 3 polysomnography (PSG) using CleveMed Sapphire PSG Type I device, 22 channels unit [22] was conducted to confirm OSA. Electrodes were placed by the international 10–20 system. Apnea–Hypopnea Index (AHI) [23] was calculated. PSQI & AHI improvement by 50% was considered successful. Contrast-enhanced CT and MRI of head and neck was suitably obtained.

Inclusion Criteria

1. Age between > 20, < 65 years

2. Recent onset (< 1 month) of symptoms of sleep disordered breathing
3. Endoscopically diagnosed static obstruction
4. PSQI score > 7/21
5. AHI > 5, < 30

Exclusion Criteria

1. Previous facial/airway surgeries
2. Unrealistic expectations
3. Refusal to participate in the study
4. Covid-19 RT-PCR positivity
5. CT Chest screening with CORADS ≥ 3

Necessary opinion(s) were obtained regarding fitness for surgery with clearance for general anesthesia. All surgeries done by a senior otorhinolaryngologist (to adjust for skill-bias) within 2 days of receiving Covid-19(-ve) RT-PCR [24] report and within 1 day of doing CT screening of chest [25]. Neural pathologies were handled with the institute's senior neurosurgeon. Surgical procedures were uneventful. Suture removal if required was done on the 7th post-op day.

PSQI was recalculated after surgical intervention before discharge (3–7 days post-op). PSQI improvement by 50% was discharged (surgery only group-SOG). If not, the candidates were counselled for repeat PSG with CPAP titration & trial (Surgery + CPAP group-SCG). ResMed AirSense 10 CPAP (ResMed AirSense 10 CPAP; ResMed, San Diego, CA) was used for all titration & trials to adjust for technical-bias. All patients initially had complete hands-on orientation to CPAP from a trained sleep technologist. CPAP compliance was monitored covertly in most patients with hour timers that were activated only when the machine was generating a pressure within 2 cm H_2O of the set pressure. All patients had a minimum 12 week home trial of CPAP. Expected compliance was > 4 h average use/night [26], for at least 2 week prior to their final assessment. Subjects who had their CPAP compliance monitored covertly signed a post-study consent form that informed them of this record, requesting that they allow their data to be used in the final analysis. No patients objected to this request. Covid-19 RT-PCR was repeated in CPAP group before recollecting data (12–20 week).

Fear of Covid-19 scale (FCV-19S) [27] & Covid-19 restrictions were used to study covid-19 as a cause for temporal delay. The participants indicate their level of agreement with the statements using a five-item Likert-type scale. The minimum score possible for each question is 1, and the maximum is 5. A total score is calculated by adding up each item score (ranging from 7 to 35). The higher the score, the greater the fear of Covid-19 [27]. Vernacular support if required was fully provided. Department Residents were blinded since the Operation Theatre (OT) list preparation

and communication with the OT manager. All respondents fully understood the item descriptions. All patients underwent psychological counselling before discharge. Review patients were dealt in a separate OPD building to prevent new clusters. Pre-treatment (PreRx) and Median (value = 3/control) FCV-19S values were compared.

The quality-of-life (QOL) assessment and its impact was calculated by Short Form-36(sf-36) [28], Sleep Apnea Quality-of-life Index (SAQLI) [29] tools. Scoring and Interpretation of sf-36 and SAQLI was done as established in the literature [29–31]. After treatment, Domain E was included in SAQLI. The sf-36 domain/total scores were comparatively easier to compute with the online version [31]. sf-36 impact scores were categorized as mild (70–100), moderate (35–70) and severe (< 35). Questionnaires were recorded at the start of study and once again after treatment completion which varied in duration (2–20 week).

Data tabulation was done using Microsoft Excel spreadsheet. Continuous data = mean ± standard deviation, categorical data = number (percent). Paired and unpaired t-test was used to compare pre- and post-treatment/control data within & between groups. Pearson's correlation done. IBM SPSS v25[IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY:IBM Corp.] used for statistical analyses. P value < 0.05 was considered statistically significant.

Results

Demographic details noted (Table 1). All consecutive cases were enrolled (N = 127) of which, 3 tested positive for Covid-19 RT-PCR; 13 had dynamic obstruction; 4 had PSQI < 7; 6 had severe OSA (AHI > 30); 4 candidates on post-op CPAP turned covid-19(+ ve). Their data was excluded from the final analysis. Complete data available for 97(n). Overall male preponderance noted. Age range was between 25 and 65 years.

Observed pathologies (Table 2). FCV-19S score (Table 3) and year-wise temporal delay parameter scores (Table 4). PSG and CPAP characteristics noted (Table 5). Sf-36 and

Table 1 Demographic details

Sr. No	Parameter (n = 97)		Value
1	Age range (years)		25–65
2	Mean age (years)		43.85 ± 11.39
3	Sex ratio (M: F)		2.19:1
4	Marital status—Married		79 (81.44%)
5	OSA Symptomatology	Snoring	88 (90.72%)
		Disturbed sleep	62 (63.92%)
		Choking spells	53 (54.64%)
		Daytime sleepiness	11 (11.34%)
		Dyspnea	36 (37.11%)
		Dysphagia	9 (9.27%)
		Mouth breathing	31 (31.96%)
6	Overall Mean BMI (Kg/m^2)		24.39 ± 4.12
7	BMI (Kg/m^2)	Normal (18.5–24.9) (n = 57)	23.57 ± 1.33
		Overweight (25–29.9) (n = 24)	28.42 ± 1.54
		Obese (> 30) (n = 16)	31.75 ± 1.91
8	Mean Neck circumference (in cms)		37.82 ± 4.45
9	Educational qualification	High-School	11 (11.34%)
		Graduate	58 (59.79%)
		Professionals	28 (28.87%)
10	Comorbidities	Systemic hypertension (HTN)	14 (14.43%)
		Diabetes mellitus Type 2 (T2DM)	33 (34.02%)
		Bronchial asthma (BA)	2 (2.06%)
		Old Pulmonary Tuberculosis (PTB)	3 (3.09%)
		Coronary Artery Disease (CAD)	7 (7.22%)
		Seizure	0
		Thyroid disorder (TD)	8 (8.25%)
11	Habits	Smoking/reformed	21 (21.64%)
		Alcohol intake	26 (26.80%)

Table 2 Classification of Atypical pathologies presenting as OSA with treatment and year comparison

Sr. No	Parameter (n = 97)		Treatment	Data
1	Abscess	Peritonsillar	IVAB + incision & drainage	23
		Parapharyngeal		19
		Retropharyngeal		2
		Ludwig's angina		15
2	Epiglottitis		IVAB & IVS	2
3	Tonsil	Tonsillar lymphoma	Coblation Tonsillectomy ± chemotherapy	2
		Granulomatous disease of tonsil		1
4	Head and Neck airway lesions (HNAL)	Schwannoma—Hypoglossal	Transcervical excision	1
		Schwannoma—Vagal		2
		Torus tubarius cyst	Marsupialisation	2
		Rhinosporidiosis	Laser excision	13
		thornwaldt's cyst	Marsupialisation	1
		Mesenchymal chondrosarcoma	Chemotherapy	1
		Inverted papilloma	Medial Maxillectomy	13
Total				97

	Condition	Year 2019–20	Year 2020–21	*p* value
1	Abscess	9	59	0.001
2	Epiglottis/tonsils	1	5	0.029
3	Head and neck airway lesions	23	33	0.426

Table 3 Fear of Covid-19 Scale (FCV-19S)

Paired samples test—mean differences

Parameter		Mean difference	Std. deviation	95% confidence Interval		t	df	Sig. (2-tailed)
FCV-19S	Item description			Lower	Upper			
Item 1	PreRx_FCV-19S – Vs – Median_FCV-19S	1.63	0.65	1.50	1.76	24.66	96	0.001
Item 2		1.53	0.78	1.37	1.68	19.30		
Item 3		1.11	0.48	1.02	1.21	23.04		
Item 4		1.81	0.49	1.72	1.91	36.78		
Item 5		1.03	0.39	0.95	1.11	25.77		
Item 6		0.98	0.43	0.89	1.07	22.30		
Item 7		0.77	0.55	0.66	0.88	13.85		
Total		8.87	1.34	8.60	9.14	65.38		

SAQLI observations (Table 6). Pearson's Correlation coefficient values (Rho) (Table 7).

Discussion

Samples

Total referrals to the department were 127(N). This was cross-sectional prospective study with sample size 97(n) (76.38%) after applying study criteria. This was a moderate volume, hospital-based non-covid sample. Other studies [32]

had varying sample sizes–with a mix of both retrospective and prospective analysis over longer durations (≤ 10 years). Our total study duration was 18 months. Large population studies were more concerned with incidence/prevalence. Of the 127(N), 3.15%(4n) were misdiagnosed as OSA.

Covid-19 status

Subjects were Sars-Cov-2(− ve). No fever spikes/new covid symptoms were recorded during hospital stay. As a precaution, repeat Covid-19 RTPCR was done at the time of review. All Covid-19(+ ve) candidates were enrolled in a

Table 4 Year-wise temporal delay

Sr. No	Parameter	Pre-covid (Jan 2019—Feb 2020)	Post-covid (Mar 2020—Sept 2021)	p value
1	Distance from hospital (Kms)	10.02 ± 7.98	117.45 ± 146.63	0.001
2	Commuting—ambulance	30%	78%	0.01
3	Pain-to-door (mins)	185 (30, 300)	33,254 (10,080, 45,070)	0.001
4	Door-to-emergent treatment (mins)	45 (30, 120)	720 (600, 2570)	0.001
5	Door-to-GA workup (mins)	480 (300, 900)	1280 (700, 2700)	0.001
6	Door-to-Covid19 RT PCR (mins)	0	1440 (720, 1800)	0.001
7	Door-to-elective treatment (mins)	3200 (2880, 4320)	14,400 (10,080, 20,160)	0.001
8	Pre-hospital causes for delay			
	Multiple hospital referrals	10%	83%	0.001
	Transportation/Delay in acquiring E-Pass (mins)	120 / 0	600 / 7200	0.01 /0.001
	Unavailability of cabs due to lockdown (mins)	0	360 (300, 480)	0.001
	Fear of Covid-19 (FCV-19S)	0	29.87	0.001
	Hesitant to seek urgent medical care (mins)	3100 (2880, 4320)	20,160 (14,400, 30,240)	0.001
	Watchful observation & masterly inactivity (mins)	3850 (3200, 5840)	28,840 (22,080, 36,400)	0.001
	Self-prognosticating (mins)	3520 (2800, 4320)	31,050 (25,540, 36,040)	0.001
9	Travelling from containment zone—within district (mins)	3100 (2880, 4320)	24,200 (18,600, 30,600)	0.001

Table 5 PSG and CPAP titration—trial characteristics [Surgery + CPAP Group (SCG)]

Sr. No	Characteristics (n = 19)		Value		p
			Pre-treatment	Post-treatment	
1	AHI		15.46 ± 5.33	6.94 ± 2.26	0.001
2	OSA	Moderate	7 (36.84%)	–	0.001
		Mild	12 (63.16%)	19(100%)	
3	RDI		35.2 ± 13.6	7.3 ± 5.6	0.001
4	Average SpO2 (%)		92.37 ± 2.04	96.88 ± 3.12	0.063
5	Lowest SpO2 (%)		85.16 ± 4.38	94.47 ± 2.19	0.027
6	Residual AHI after CPAP titration		9.05 ± 3.19		
7	CPAP pressure titration (cms of H_2O)		9.94 ± 2.38		
8	CPAP compliance		19 (100%)	17 (89.47%)	0.055
9	Mean usage of CPAP (hours)		5.27 ± 1.55		

different study. In some studies, covid-19 (+ ve)/suspect/ (− ve) patients have been researched on OSA [33, 34].

Table 1 The age range was 25–65 years, mean age $= 43.85 \pm 11.39$ years. In a study on OSA [35], mean age was 46.8 ± 9.3 with age range of 30–69 years. In studies with covid(+ ve) OSA patients, the mean age was 52.7 ± 17.4 [34] and 56.21 ± 15.44 years [36] and an age range of 47–72 with a modest difference from our study values. The M:F ratio in our study was 2.19:1 with male preponderance. In our study, gender-wise observation and differentiation of results was not done. All were considered as a single cohort. In a study [37] reviewing epidemiological data on OSA, M:F = 2:1 was in close accordance with our study. A pilot study [38] during covid-19 pandemic showed a massive female preponderance (M:F = 1:5.4). Most of the candidates were married (n = 79,81.44%). The unmarried/singles (n = 18,18.56%; 15 M + 3F) were presented by his/her family members/local guardians as they felt concerned with the start of recent-onset snoring and disturbed sleep patterns. In other studies [27, 39], this data was more than just a demographic detail. They concluded that married patients had better response and adherence to treatment options.

The most common clinical feature among our subjects was snoring (n = 88,90.72%) and disturbed sleep (n = 62,63.92%). Other features of OSA like choking spells, difficulty in breathing and mouth breathing were between 53 and 31%% respectively in decreasing order of presentation. Symptomatology in similar studies [40] were more or less in accordance. Daytime sleepiness was negligible.

The overall BMI $= 24.39 \pm 4.12$ kg/m^2, tagging the sample as 'high normal'. The individual BMI category were normal (n = 57,58.76%; 23.57 ± 1.33), overweight (n = 24,24.74%; 28.42 ± 1.54) and obese (n = 16,16.49%; 31.75 ± 1.91). The authors felt that obese individuals may already have an OSA background and that the pathology compressing the airway was unmasking the disease. In striking contrast,

Table 6 Statistical analysis of study tools

Sr. No	Parameter Tool	Overall Pre-treatment	SOG (n=78) Post-op (<2 week)	Paired t p value	SCG (n=19) (12–16 week) Post-op Pre-CPAP	Post-op Post-CPAP	Paired t p value	Unpaired t p value
1	Mean PSQI	15.93 ± 3.38	7.04 ± 1.68	0.001	13.15 ± 4.18	6.45 ± 1.77	0.001	>0.05
2	Mean AHI	19.73 ± 8.72	7.11 ± 1.83		15.46 ± 5.33	6.94 ± 2.26		
3	sf-36 PF	68.17 ± 15.62	78.37 ± 11.47		–	70.22 ± 12.31	0.044	0.027
	sf-36 RF	56.24 ± 12.59	74.56 ± 16.83		–	72.56 ± 17.45	0.001	>0.05
	sf-36 BP	67.01 ± 13.07	69.98 ± 14.84	0.048	–	67.98 ± 16.21	0.544	
	sf-36 GH	61.27 ± 14.78	84.87 ± 14.33	0.001	–	82.87 ± 15.43	0.001	
	sf-36 VT	59.73 ± 15.43	85.76 ± 17.95		–	82.37 ± 19.77		
	sf-36 SF	67.71 ± 16.29	73.61 ± 16.28		–	74.56 ± 20.15		
	sf-36 RE	71.92 ± 18.86	77.56 ± 18.24		–	73.98 ± 17.42		
	sf-36 MH	73.37 ± 19.94	88.62 ± 16.47		–	85.87 ± 18.22		
4	sf-36: Mean PCS-36	63.19 ± 15.14	76.23 ± 16.83		–	73.71 ± 17.21		
	sf-36: Mean MCS-36	68.13 ± 21.32	81.38 ± 18.29		–	79.34 ± 20.76		
5	SAQLI A	4.43 ± 0.48	5.59 ± 0.33		–	4.87 ± 0.42		
	SAQLI B	3.98 ± 0.56	5.04 ± 0.27		–	4.96 ± 0.75		
	SAQLI C	4.36 ± 0.26	5.31 ± 0.25		–	4.89 ± 0.53		
	SAQLI D	3.08 ± 0.39	5.19 ± 0.42		–	5.02 ± 0.51		
	SAQLI Total	4.08 ± 1.14 (A–D)	5.68 ± 1.07 (A–E)		–	5.13 ± 1.11 (A–E)		
6	Time duration (Surgery—<2 week vs. Surgery+CPAP—12–16 week)							0.001

Sf-36 [27] is an 8-domain QOL tool which codes for physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH)—contributing to physical component score (PCS-36) and vitality (VT), social functioning (SF), role emotional (RE) and mental health (MH). SAQLI – Sleep Apnea Quality of Life Index [28] with domains A–D for pre-treatment and A–E for post-treatment. SOG—Surgery only group, SCG—Surgery_CPAP group

Table 7 Correlation coefficient (Rho)

Sr. No	Correlation coefficient (Rho)	BMI	NC	AHI	PSQI	SF-36	SAQLI
1	BMI	1	0.113	0.307	0.352	−0.118	−0.098
2	NC	0.113	1	0.012	0.045	0.097	0.088
3	AHI	0.307	0.012	1	0.896	−0.147	−0.126
4	PSQI	0.352	0.045	0.896	1	−0.132	−0.215
5	SF-36	−0.118	0.097	−0.147	−0.132	1	0.943
6	SAQLI	−0.098	0.088	−0.126	−0.215	0.943	1

non-obese individuals (n=81,83.51%) also suffered OSA due to primary airway obstruction. In other studies, mean BMI=31.2 ± 0.5, range 20.9–45.1 kg/m² [41, 42] with overall obese individuals suggesting to check weight gain in patients undergoing treatment for OSA.

A notable feature was that 100%(n=57) of normal, 70.83%(n=17) of overweight and 25%(n=4) of obese BMI category (total n=78,80.41%) benefitted with the primary surgical intervention. 29.17%(n=7) of overweight and 75%(n=12) of obese BMI category(total n=19,19.59%) required add-on treatment. The mean NC=37.82 ± 4.45cms. This apparently put the entire cohort in overweight/obese category [43] but individually there was a mix of normal, overweight and obese categories. This value was supported by studies [44, 45] where the mean neck circumference was 39.2 ± 4.7 cms, 42 cms (median) with range 35–50 cms for OSA patients. This showed a modest variation of 2–4 cms between studies.

Educational qualification of study participants were professionals 28.87%(n=28), graduates 59.79%(n=58), high-school 11.34%(n=11). A recent study on Covid-19 [46] showed 32.3%(n=51) doctors, 64.6%(n=102) nurses & 3.2%(n=5) paramedical personnel were involved. High-school group needed vernacular support to complete questionnaires as anticipated. Majority of the study population were graduates. Educating the primary physician and population about advances in diagnosis and management of OSA/Covid-19 to give better outcomes was highlighted [47, 48].

Detailing the co-morbidity profile, HTN-14.43%(n = 14); T2DM–34.402%(n = 33); BA–2.06%(n = 2); PTB–3.09%(n = 3); CAD–7.22%(n = 7) and TD–8.25%(n = 8). All were on regular medications and surgically fit. Old PTB patients had completed 8–9 months of Anti-tubercular treatment (ATT) and were sputum(− ve). In comparative studies on OSA [49, 50], a high risk for worsening of co-morbidities was noted. Smoking/Reformed smokers (n = 21,21.64%), alcohol intake(n = 26,26.80%) history was available for 39.18%(n = 38). Studies [51, 52] researching smoking and alcohol influence on OSA have concluded on definite possible association/worsening of OSA.

Table 2 OSA due to abscesses formed the bulk of our sample (n = 59,60.82%) [53] followed by HNAL (n = 33,34.02%) [54–57]. Other unique pathologies mimicking OSA in our series presented as large crops over a short duration. This apparent increase in volume between consecutive years (33 vs. 97, p = 0.001) was statistically significant—more so due to specialist referrals, fear of Covid-19 and refusal of patients to go to hospitals which have been recently converted to covid-19 care centres(Tables 3, 4). The HNAL in 2019–20 was 23 as opposed to 33 in 2020–21. However, they were all head-neck malignancies–more of carcinoma larynx and not atypical pathologies.

Tables 3, 4 Fear of covid-19/restrictions was studied as a factor influencing treatment proceedings. Table 3—comparing Pre-Rx and Median statistical values of FCV-19S showed statistically significant differences. No parameter had negative value indicating that all items performed well. Similar studies on assessing fear of corona virus highlighted vulnerable high-risk groups [58, 59]. Another study [60] developed a behaviour predictor model. Table 4—year-wise study on temporal delay with variables obtained after imposing lockdown showing a statistically significant paradigm shift in time taken to access medical services. Recent studies [61–63] have made reinforcing statements, though with different parameters.

Table 5 OSA screened with PSQI. Scores < 5 have no significant OSA association [64]. Using PSQI > 7 in a singular assessment, authors felt that having a higher cut-off would filter actual OSA sufferers. SOG (n = 78) had mean post-op PSQI of 6.04 ± 1.68. 19 candidates who persistently had PSQI > 7(13.15 ± 4.18) were counselled for post-op CPAP and added in SCG. Final mean post-CPAP PSQI value = 6.45 ± 1.77. Treatment differences were statistically significant. In studies with PSQI [21, 64] score < 7 was considered less probable for OSA and established that the tool fulfils its intended utility as a screening tool. Other studies used Epworth Sleepiness Scale (ESS) [29], though it may not apply at all circumstances [21]. In another study [65], both have been disregarded as screening tools.

The mean AHI, OSA severity, RDI, lowest SpO_2 differences were statistically significant (p < 0.001). The average

SpO_2 difference was not of strong statistical significance (p = 0.027). Mean residual AHI on CPAP titration(1st night of PAP trial) was 9.05 ± 3.19. Mean CPAP pressure titration was 9.94 ± 2.38 cms of H_2O. 2 candidates used CPAP < 4 h/night–lowered compliance rates. Compliance at 12-week CPAP usage was 89.47%(n = 17). This was however statistically significant (expected 60% compliance). In-fact, efforts were made by the department secretary through proactive phone calls to maintain a proper attitude of the candidates regarding CPAP compliance and provided better adherence. In another study [66], Oxygen desaturation index(ODI) was measured. PSG parameters were comparable; OSA severity was more, compliance and final AHI were less.

Table 6 The overall PreRx mean AHI(19.73 ± 8.72) showed an apparent moderate severity of OSA. The mean AHI in SOG was 7.11 ± 1.83 (n = 78, post-treatment). AHI was 15.46 ± 5.33 in 19n and added-on to the CPAP group (SCG). This cohort consisted of moderate (n = 8,42.11%) and mild OSA (n = 11,57.89%). The SCG had mean AHI 6.94 ± 2.26 on completing CPAP trials. Our study reinforced that single modality alone may not yield satisfactory results at all times. In a study [67], research on "Effective AHI" was conducted on PAP users. A statistically significant difference (p < 0.001) was found between effective AHI(18.3)-diagnostic AHI(67.9). They concluded that this would enable the clinician to directly predict the residual disease burden.

The observed overall mean physical health composite score (PCS-36) and the mental health composite score (MCS-36) differences were statistically significant in both groups. The individual domain differences of sf-36 which were not statistically significant was sf-36 BP (p = 0.544) in SCG. The sf-36 BP in SOG (p = 0.048) and sf-36 PF in SCG (p = 0.044) differences were of weak statistical significance. This showed a moderate impact on QOL. The final unpaired t-test values were not statistically significant (p > 0.05) between SOG and SCG except for sf-36 PF (p = 0.027). This sort of impact on QOL could be due to short duration of symptomatology/recent onset OSA features. Both had equal final outcomes but SOG achieved it earlier (2 vs. 12–20 week) (p < 0.001). As a common health-related QOL [68], in studies on OSA with sf-36 [29, 66, 69], almost comparable values were obtained except in the vitality (sf-36VT) domain. In another study [26], the individual as well as overall pre-treatment scores were lower compared to our study denoting a baseline lower (average/below-average) QOL. This could possibly be explained by a longer duration of disease suffered by the candidates. OSA severity did not influence QOL. From our study, with a short duration of disease, multiple domains fared well. End-point changed from moderate to mild impact on QOL.

SAQLI showed overall mean differences were statistically significant in both groups (p < 0.001). Between the groups, final scores were not statistically significant

($p > 0.05$) indicating that both groups had comparable QOL after treatment. The overall mean pre-treatment SAQLI score was 4.08 ± 1.14 versus 5.68 ± 1.07 in SOG/ 5.13 ± 1.11 in SCG. In all 4 domains(A–D), statistically significant differences were observed($p < 0.001$) which demonstrated that QOL definitely improved after primary treatment. The only debatable factor in both groups would be time duration of achieving this QOL endpoint. In similar studies with SAQLI [29, 69], a rating of change (ROC) in domain values has been studied instead of absolute values whereas another study [26] used absolute values. The conclusions from these studies were in accordance with ours. In some studies [70, 71], FOSQ(Functional Outcome Sleep Questionnaire) and OSA-18(Pediatric OSA) QOL tools were respectively used for different samples.

Table 7 BMI correlated weak(+ ve) with NC(0.113), AHI(0.307), PSQI(0.352); weak(− ve) with sf-36(−0.118), SAQLI(−0.098). Other significant correlations were between sf-36 and SAQLI (strong + ve, 0.943); between AHI and PSQI (strong + ve, 0.896). As against expectation, BMI did not fare well as a single factor in predicting impact on QOL and mixed correlations were obtained. No solid predictions were possible with NC as an isolated utility. This scenario was probable as a majority of non-obese candidates also suffered from OSA. In other studies [70–72], correlations were mixed and inconclusive. In another study [73], multiple tool and OSA parameter correlation was done and observed that AHI showed no significant correlation with sleep and mood related scale.

As per study criteria, 50% improvement in AHI/PSQI was considered successful. In that context, all candidates (97,100%) benefitted with the treatment options at the end of trial. However, on critical appraisal, surgery alone (n = 78) was 80.41% successful. The fraction of sample which went for post-op CPAP (n = 19) could reflect failure rate (19.59%). This was reflected in a study [74, 75] where they opined that proper selection of candidates for appropriate treatment would definitely improve success rates.

Limitations

Only hospital population based. Separate male vs. female outcomes not evaluated. Pediatric population not included. Severe OSA were excluded—this cohort may need multimodal management. Long term follow-up of patients not done. Multiple regression analysis not done with factors causing temporal delay in healthcare acquisition to find element with most weightage—elaborate but grounds for further research in similar/different models.

Conclusion

OSA was unmasked due to over-burdening of the airway by the deep-seated head and neck pathologies, affecting the non-obese category also. Fear of Covid-19 acquisition is still perilous, hindering access to proper healthcare facilities. Recent-onset OSA impact on QOL is significant & improves after selective primary treatment. Add-on treatment gives better success rates. With strict lockdown and current pandemic scenarios, spreading awareness via Press/audio-visual media/flyers to seek proper and timely medical attention would definitely help. Vaccination drive must spearhead.

Code Availability   MS Excel was used. Computed with IBM SPSS v25.

Declarations

Conflict of interest   The authors declare that they have no conflict of interest.

Ethical Approval   Obtained.

Human and Animal Rights   Research involving human participants and/or animals—yes.

Informed Consent   Written informed consent obtained.

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