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Sleep-disordered breathing in patients with acquired retrognathia secondary to rheumatoid arthritis

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Summary

Background: Sleep-disordered breathing (SDB) is associated with a variety of conditions that cause upper-airway narrowing. It was hypothesized that upper-airway narrowing can occur in patients with rheumatoid arthritis (RA) when retrognathia develops secondary to temporomandibular joint (TMJ) destruction. Therefore, the aim of this study was to detect the prevalence of SDB in patients with acquired retrognathia secondary to rheumatoid arthritis and to assess the efficacy of nasal continuous positive airway pressure (nasal CPAP) therapy in patients with SDB.

Material/Methods: Employed were a questionnaire, lateral cephalometry, and overnight polysomnography in seven women and three men (mean age ±*SD*: 50±20 years, mean body mass index: 24.2±5.7 kg/m^2) with acquired retrognathia secondary to RA.

Results: Three patients had severe obstructive sleep apnea (OSA) with apnea+hypopnea indices (AHI) >60/hour, three had mild obstructive sleep hypopnea (AHI >10/hour), and four had AHI <10/hour. The three patients with severe OSA all had excessive daytime sleepiness and evidence of retrognathia. In these three patients the mean AHI decreased from 72/hour to 3/hour with nasal CPAP therapy.

Conclusions: SDB occurs quite frequently in non-obese patients with acquired retrognathia secondary to RA. The severity of SDB is related to the degree of retrognathia and the presence of daytime sleepiness. Nasal CPAP therapy is effective and well tolerated in these patients.

key words: **obstructive sleep apnea • upper airway • retrognathia • temporomandibular joint • rheumatoid arthritis**

Abbreviations: **OSA** – obstructive sleep apnea; **TMJ** – temporomandibular joint; **RA** – rheumatoid arthritis; **HI** – hypopnea index; **AI** – apnea index; **CPAP** – continuous positive airway pressure; **EEG** – electroencephalographic; **EOG** – electrooculographic; **EMG** – electromyographic; **ECG** – electrocardiogram; **SaO_2** – arterial oxygen saturation

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Background

Sleep-disordered breathing is a common condition which occurs because of recurrent upper-airway occlusion during sleep. Obesity is present in the majority of patients with SDB and is considered to be a major risk factor for its development [1]. It is well recognized that a minority of patients with sleep-disordered breathing have gross anatomic abnormalities that cause upper-airway narrowing. These include upper-airway tumors [2], adenotonsillar hypertrophy [3], and macroglossia [4]. Acquired retrognathia secondary to temporomandibular joint (TMJ) destruction in rheumatoid arthritis (RA) has also been proposed as a rare cause of SDB. RA is a common disorder which can affect upper-airway size and function by involving the temporomandibular joint (TMJ), larynx, and cervical spine. TMJ involvement is quite common and can result in acquired retrognathia and cause upper-airway obstruction [5]. Although there are several case reports of sleep-disordered breathing in patients with acquired retrognathia secondary to TMJ involvement by RA, there are no detailed studies of this condition. We prospectively studied 10 patients with acquired retrognathia secondary to TMJ destruction by RA to evaluate the prevalence of SDB and to assess the efficacy of nasal continuous positive airway pressure (nasal CPAP) therapy in the patients with SDB.

Material and Methods

Patients

Ten patients, seven women and three men aged (mean ±SD) 50±20 years with a mean body mass index of 24.2±5.7 kg/m^2, with acquired retrognathia secondary to RA were approached to participate in the study. All patients gave informed consent for participation. The patients underwent a detailed history and physical examination. Anthropometric measurements including weight, height, and neck circumference, and blood pressures were taken. Patients were considered to have obstructive sleep apnea if the apnea index (AI) was >5/h or the apnea and hypopnea index (AHI) >15/hour.

Polysomnogram

Sleep and its various stages were observed for each patient and documented by standard electroencephalographic (EEG), electrooculographic (EOG), and electromyographic (EMG) criteria. EEG was recorded with electrodes applied at C3-A2 and C4-A1 (according to the international 10–20 system) and EMG activity was recorded from submental muscles and anterior tibialis muscles [6]. Apnea was documented by an infrared CO_2 analyzer (Model LB-2, Beckman Instruments Inc, Sciller Park, IL, USA) which recorded from both the nose and mouth. A single EKG was monitored in order to detect cardiac arrhythmias. Arterial oxygen saturation (SaO_2) was monitored continuously with a pulse oximeter (Ohmeda 3700). Chest wall movement was monitored by a respiratory inductive plethysmograph (Respitrace, Ambulatory Monitoring Equipment, Ardsley, NY, USA). Sleep stage and respiratory variables were analyzed independently. The entire overnight record was manually scored for sleep stage, apnea/hypopnea type, and duration. Apnea was defined as cessation of airflow for greater than 10 seconds and hypopnea was defined as a 50% decrease in thoracoabdominal (Respitrace sum) amplitude for greater than 10 seconds.

Nasal CPAP

Conventional nasal CPAP was provided by a Respironic REM Star system to the three patients with retrognathia secondary to RA with severe OSA. Optimal nasal CPAP was determined by a technologist instructed to increase the CPAP pressure from 5 cm-H_2O in 2.5-cm-H_2O increments to eliminate apnea, hypopnea, arterial oxygen desaturation below 85%, and arousal associated with snoring.

Results

The seven women and three men underwent overnight polysomnography. Their individual anthropometric and polysomnographic data are presented in Table 1. Three patients (30%) had significant OSA (mean AHI: 72±11/hour), six patients (60%) had mild obstructive hypopnea (mean AHI: 10.5±4/hour), and one patient (10%) had a normal study. The three patients with OSA were all successfully treated with nasal CPAP (mean pressure: 10±4 cm-H_2O, range: 5–12.5 cm-H_2O) with symptomatic improvement and complete resolution of OSA, documented during repeat PSG (mean AHI decreased to 3±1/hour). Figures 1 and 2 show retrognathia and upper-airway narrowing in the erect position that significantly worsened in the supine position in one patient with OSA.

Discussion

Although there are several case reports relating SDB to acquired retrognathia secondary to TMJ destruction by RA, there have been no detailed studies of the pathogenesis, prevalence, or effect of treatment on SDB in this condition. We believe this is the first prospective study to evaluate OSA in patients with acquired retrognathia secondary to RA in which all patients underwent polysomnography and a follow-up polysomnography was performed in the patients with OSA after nasal CPAP to evaluate the efficacy of such therapy. Our results indicate that SDB occurs frequently in non-obese patients with acquired retrognathia secondary to RA. The occurrence and severity of SDB is directly related to the degree of retrognathia and severity of symptoms, but does not appear to be related to patient age. Furthermore, we also demonstrate that nasal CPAP is a safe and effective therapy for these patients.

RA is a common disorder which can affect upper-airway size and function by involving the TMJ, larynx, and cervical spine. TMJ involvement is quite common, and in a large series of patients with rheumatoid arthritis, 55% reported pain in the TMJ, 40% exhibited tenderness on examination, 63% had crepitus in the joint on auscultation, and 80% had radiographic changes in TMJ [5,7]. Alteration in bite alignment is often the most common sign. The bite opening decreases and the chin recedes as the mandibular condyle erodes and the temporal fossa is destroyed. Upper-airway obstruction caused by acquired retrognathia secondary to temporomandibular involvement was first reported by Conway and associates in a middle-aged woman with juvenile RA [8]. Davies and Iber reported a 68-year-old man with severe OSA secondary to TMJ involvement. Inspiratory upper-airway resis-

Table 1. Baseline characteristics and sleep study results of patients (n=10) with retrognathia secondary to rheumatoid arthritis.

Patient no.	Age (years)	Sex	Symptoms	Signs	Polysomnography apnea/hypopnea index	
1	25	F	Snoring	BMI 22.6 kg/m^2 NC 32 cm Retrognathia	2 / hour	Normal
5	38	F	Loud snoring	BMI 19.4 kg/m^2 N C 31 cm Retrognathia	8 / hour	Mild obstructive sleep hypopnea
8	64	M	Loud snoring Reported apnea Daytime sleepiness	BMI 34.5 kg/m^2 NC 43 cm Retrognathia	8 / hour	Mild obstructive sleep hypopnea
7	35	F	Loud snoring	BMI 20.6 kg/m^2 NC 35 cm Retrognathia	10 / hour	Mild obstructive sleep hypopnea
2	74	M	Loud snoring	BMI 27.1 kg/m^2 NC 42 cm Retrognathia	12 / hour	Mild obstructive sleep hypopnea
4	25	F	Loud snoring	BMI 19.6 kg/m^2 NC 33 cm Retrognathia	13/hour	Mild obstructive sleep hypopnea
10	52	F	Loud snoring	BMI 29.9 kg/m^2 NC 38 cm/m^2 Retrognathia	13 /hour	Mild obstructive sleep hypopnea
6	70	M	Loud snoring Reported apnea Daytime sleepiness	BMI 21.6 kg/m^2 NC 37 cm Retrognathia	61/hour Severe arterial oxygen desaturation	Severe obstructive sleep apnea
3	48	F	Loud snoring Reported apnea Daytime sleepiness	BMI 29.6 kg/m^2 NC 36 CM Retrognathia	74/hour Severe arterial oxygen desaturation	Severe obstructive sleep apnea
9	73	F	Loud snoring Reported apnea Daytime sleepiness	BMI 16.8 kg/m^2 NC 36 cm Retrognathia	82/hour Severe arterial oxygen desaturation	Severe obstructive sleep apnea

tance measured during wakefulness in this patient was only slightly increased compared with normal control subjects [9]. Pepin et al. also reported a 62-year-old woman with OSA in association with acquired retrognathia and subluxation of C3-C4 secondary to RA. Their patient had significant reduction in the size of the upper airway [10].

RA of the cricoarytenoid joint can cause acute and chronic upper-airway obstruction through laryngeal involvement, and this condition should not be mistaken with OSA as they usually present with hoarseness, pain in the larynx, foreign body sensation in the throat, and absence of symptoms related to sleep disorder. Laryngoscopic examination is usually used for diagnosis [11,12]. Redlund-Johnell retrospectively reviewed 400 patients with RA and found 76 with temporomandibular involvement. Although polysomnography was not performed, at least 30 of these patients had evidence of recurrent upper-airway obstruction [13]. The pathogenesis of upper-airway obstruction in these patients has been attributed to a retracting tongue or mandibular retrusion. A posterior displacement of the genioglossus muscle results in a tongue that lies much closer to the posterior pharynx. With the reduction in muscle tone that occurs during sleep, this situation is exacerbated.

Recently, increased circulating levels of the proinflammatory cytokine tumor necrosis factor-α (TNF-α) have been found to play an important role in the pathogenesis of RA and OSA [14]. In a recent study, the use of etanercept, a medication that neutralizes TNF-α in the treatment of RA, on eight obese male apneics showed significant and marked decrease in sleepiness, increased sleep latency, and a reduction in the number of apnea/hypopneas episodes/hour compared with placebo [15]. In another study infliximab, a chimerical monoclonal antibody to TNF-α used for treating severe RA, showed a significant worsening of OSA by increasing the number of apneic episodes and SaO_2 dips while improving arousals [16,17]. The reasons for these contradictory findings remain obscure. The high incidence of SDB in our subjects should draw the attention of the physicians dealing with RA patients to the presence of OSA, especially if the patient has symptoms suggestive of OSA, and then a polysomnography should be done routinely for diagnosis. Recognition of OSA disorder is very important

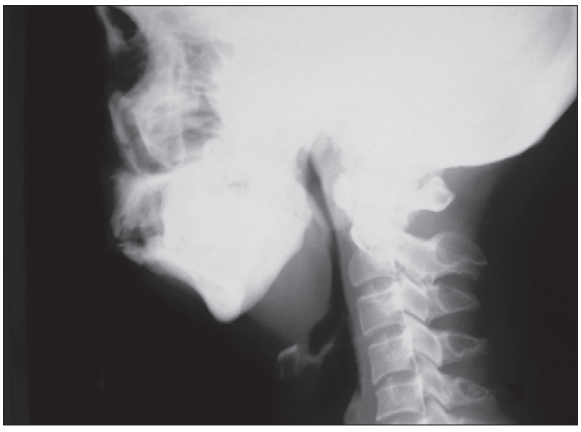

Figure 1. Lateral cephalometry in erect position showing retrognathia and narrowing upper airway.

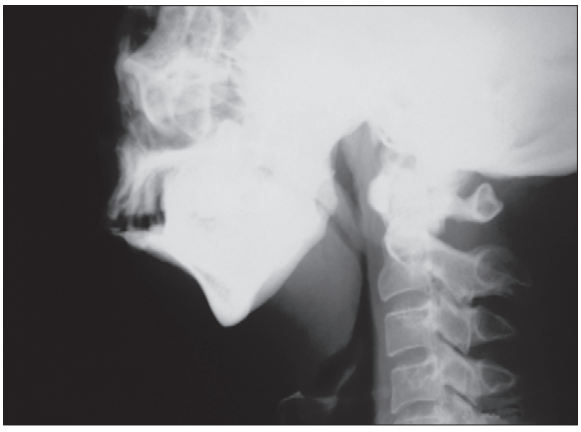

Figure 2. Lateral cephalometry in supine position showing more narrowing and collapse of the upper-airway lumen.

as it could be fatal if not recognized early. Tracheostomy was the primary available therapy in all cases reported before 1985. Since its introduction, nasal CPAP has become the therapy of choice for OSA. CPAP acts as a pneumatic splint that keeps the upper airway open during sleep [18]. Recently, nasal CPAP was reported to increase left ventricular function and to reduce blood pressure [19]. Moreover, it also improves metabolic function of OSA patients by reducing insulin resistance [20]. In our study, nasal CPAP therapy was used in the three patients with OSA, and follow-up polysomnography showed complete resolution of their apneas and improvement in O_2 saturation.

Dental appliances have been used in mild to moderate OSA [21]. These work by moving the mandible forward, and consequently the tongue, with the use of an anterior mandibular device. However, this modality of therapy needs further evaluation before its use is recommended in retrognathia secondary to TMJ damage because it may cause jaw pain and may aggravate TMJ destruction.

Recently, bilateral total replacement of the TMJs was developed as a new treatment modality for patients with acquired micrognathia associated with RA. The surgical procedure involves the replacement of the condylar processes, glenoid fossa, and articular tubercle with artificial materials [22,23]. This operation improves upper-airway obstruction of patients with RA-associated micrognathia without affecting the quality of life, in comparison with traditional treatment modalities such as nasal CPAP and tracheostomy. However, general anesthesia for this surgical TMJ intervention in RA patients poses many problems, including laryngospasm, bilateral submandibular swelling, difficulty in ventilation via face mask, tracheal intubation at induction, and repetitive supraglottic obstruction during anesthesia and after extubation [23,24]. Therefore, anesthetists should be aware of RA patients with OSA who are going for surgery and all precautions should be taken to protect them from having upper-airway obstruction pre- and postoperatively by using nasal CPAP therapy. In patients undergoing TMJ replacement, the use of nasal CPAP presents a special difficulty. In these patients, upper-airway obstruction can be avoided by prolonged intubation overnight and extubation should be performed when returning consciousness and airway patency are confirmed [23,24]. Patients having nasal surgery present special difficulty, particularly if their noses have been packed. CPAP can be applied via a full face rather than nasal mask in such cases [23,24].

Conclusions

SDB occurs frequently in non-obese patients with acquired retrognathia secondary to RA. The severity of the sleep-disordered breathing is related to the degree of retrognathia and the presence of daytime sleepiness. Physicians should be aware of this condition and a polysomnography should be ordered for RA patients with retrognathia if they have excessive daytime sleepiness, loud snoring, or reported apneas. We recommend the use of nasal CPAP therapy in RA patients with retrognathia if they have OSA.

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