

Adherence to CPAP in Patients With Obstructive Sleep Apnea in a Chinese Population

Yan Wang MM RN, Weijie Gao MM RN, Mei Sun MM, and Baoyuan Chen MD

BACKGROUND: CPAP is the first choice for most patients with obstructive sleep apnea (OSA), but the adherence to CPAP is suboptimal. The purpose of this study was to assess the adherence to CPAP therapy of Chinese OSA patients with CPAP therapy. **METHODS:** Two-hundred ten patients who had been diagnosed with OSA and had experienced CPAP titration trial as prescribed were enrolled in this study. Subjects were identified by reviewing our Snoring and Sleep Apnea Unit's records. The patients were interviewed by telephone and were asked to assess their CPAP use time. Those who said their CPAP use time was less than 4 h/d for 70% of the nights per week were questioned about their reasons for non-adherence. **RESULTS:** Seventeen patients were lost to follow-up. One-hundred ninety-three patients participated in our survey. Patient demographics included male/female (162/31), mean \pm SD age (51.91 ± 10.10 y), and mean apnea-hypopnea index (59.99 ± 21.51 events/h). At the time of the interview (59 ± 32 months after initial titration trial), 100 of 193 patients (51.8%) were still using CPAP, 29 of 193 patients (15.0%) had abandoned CPAP after using it for a period, and 64 of 193 patients (33.2%) had never commenced therapy after titration. The most common reasons cited by the patients for the poor adherence were they were not able to acclimatize to the CPAP during the titration night, they did not perceive the need or the benefits of the treatment, or found it troublesome to use CPAP every night. **CONCLUSIONS:** The CPAP adherence is low in Tianjin, China. Only one half of these patients remained adherent to the treatment, and the other one half of these patients either never initiated the treatment or had abandoned CPAP use. To improve CPAP adherence, the medical staff should pay attention to making the titration trial a comfortable first CPAP experience for the patients. It is also very important to give the patients education and support about CPAP use in the follow-up, especially early on in this treatment. *Key words:* CPAP; adherence; obstructive sleep apnea; OSA; China. [Respir Care 2012;57(2):238–243. © 2012 Daedalus Enterprises]

Introduction

Obstructive sleep apnea (OSA) is a prevalent medical condition. Recent data showed there were at least 52 million people suffering from OSA in China.¹ The symptoms and prognosis of OSA include excessive daytime sleepi-

ness, impaired neurocognitive performance, and fragmented sleep architecture, which, in turn, lead to emotional fatigue.^{2,3} Patients with OSA are at increased risk of developing arterial hypertension, stroke, and myocardial ischemia, and therefore have increased cardiovascular morbidity.⁴ CPAP is the most effective treatment for patients with OSA.⁵ Campos-Rodriguez et al⁶ found that long-term CPAP produces a modest reduction in blood pressure in patients with hypertension and sleep apnea, but continued use of CPAP > 5.3 h/d could cause significant reductions in blood pressure for the patients with incompletely controlled hypertension. Sopkova et al⁷ pointed out that, since adequate adherence to CPAP is essential for achievement of the cardiovascular and metabolic benefits of this treatment, it is important to determine the factors that relate to CPAP adherence.

The authors are affiliated with the Department of Respiratory Medicine, Tianjin Medical University General Hospital, Tianjin, China.

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Correspondence: Weijie Gao MM RN, Department of Respiratory Medicine, Tianjin Medical University General Hospital, Tianjin, 300052 China. E-mail: betty_gao@yahoo.com.cn.

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Few studies in English reporting Chinese CPAP adherence were retrieved. In the present study, we aimed to investigate the current condition of CPAP adherence in OSA patients in China. We also attempted to explore the reasons for non-adherence in Chinese OSA patients after the initial trial.

Methods

This study was conducted in the Snoring and Sleep Apnea Unit at the Department of Respiratory Medicine in Tianjin Medical University General Hospital, a tertiary hospital in Tianjin, a Chinese city with a population of over 10 million, between April and June 2010.

Subjects

We identified 210 OSA patients by reviewing the Snoring and Sleep Apnea Unit's records. All these patients had been diagnosed with OSA based on overnight polysomnography (PSG) and had experienced CPAP titration as prescribed by physicians who had explained the harm of OSA and the benefits of CPAP treatment for the patients in our Snoring and Sleep Apnea Unit, from July 2005 to September 2009.

The CPAP titration was standard manual titration performed with full PSG monitoring plus mask pressure, leak, and flow signals overnight. The starting pressure was 4 cm H₂O, and the pressure was increased in 1–2 cm H₂O increments to abolish apneas, hyperpnoea, and flow limitation, and to minimize respiratory effort-related arousals. For all subjects, we sought to determine the lowest pressure required to abolish the respiratory events and promote sleep continuity. All patients received 15 min of simple oral education and motivational enhancement about CPAP treatment from the sleep technicians 30 min prior to the start of the PSG. Any perceived problems arising during titration, such as mask fitting difficulties or CPAP side effects, were solved immediately during the titration night. The physicians analyzed the titration study overnight and issued a report for the determined pressure before each patient was discharged home in the morning.

If the patients decided to accept and initiate the CPAP home treatment after titration trial, they would purchase the devices themselves from the home-medical-equipment providers, as CPAP treatment is not covered by the National Medicare Insurance. For ongoing support, any technical problems related to the functioning of the equipment were covered by home-medical-equipment providers free after sales service, and patients could contact the physicians if they experienced any physical discomfort. This is the system available for patients who are prescribed CPAP. The supporting medical services are limited, and the home-care nurses are few, resulting in deficiencies in motiva-

QUICK LOOK

Current knowledge

Continuous positive airway pressure (CPAP) is commonly employed to treat obstructive sleep apnea (OSA), but compliance is poor due to discomfort and lack of perceived benefit.

What this paper contributes to our knowledge

Among a group of patients with OSA in China, half of patients either never initiated use of CPAP at home or discontinued therapy after a short time. CPAP adherence remains a worldwide issue which requires inventive solutions.

tional enhancement in the CPAP home treatment in Tianjin.

Data Collection

The medical records of the 210 patients were retrieved and reviewed. The patients were contacted by telephone by a single investigator and were asked to participate in a semi-structured telephone interview regarding their CPAP use. All consenting patients were interviewed in depth.

First, they were asked whether they were still adhering to CPAP therapy. According to patients' responses, they were divided into 3 groups. Group I included those currently using their CPAP devices. They were asked to assess whether their CPAP use time fulfilled the adherence criterion (CPAP use of at least 4 h/d for at least 70% of the nights per week⁸). If they answered "no" they would be asked to explain their lack of adherence. Group II, those not using CPAP at the time of telephone interview, would be asked to estimate how long they had tried the device and the reasons for stopping its use. Group III, patients who never initiated the CPAP therapy, were asked to list their reasons for not commencing prescribed treatment.

We retrieved the subject's name, sex, age, apnea-hypopnea index (AHI), and CPAP pressure from the medical records noted at the initial clinic visits.

The study was approved by the local ethics committee, and consenting participants were promised confidentiality and assured that their responses would not be made available to any party outside the research project.

Statistical Analysis

Data are expressed as mean \pm SD. Significant differences between the 3 groups, including those who never used CPAP, those who used but gave up CPAP, and the

Table 1. Patient Characteristics ($n = 193$)

Male/female, no.	162/31
Age, y	51.91 \pm 10.10
AHI, events/h	59.99 \pm 21.51
CPAP, cm H ₂ O	12.06 \pm 3.58
Follow-up, months	29.67 \pm 13.51

Values are mean \pm SD, unless otherwise indicated.

AHI = apnea-hypopnea index

persistent users of CPAP, were evaluated using one-way analysis of variance (ANOVA).

Results

Patients were interviewed 59 ± 32 months after the initial titration trial. Among the 210 patients, 11 patients could not be contacted and 6 refused to be interviewed. One hundred ninety-three patients agreed to participate in our survey. The subjects' characteristics are presented in Table 1.

Table 2 shows the data from the 3 groups, grouped according to their CPAP use. Sex, age, AHI, and CPAP requirement were not statistically different among the 3 groups. Patient-reported reasons for poor adherence are listed in Table 3.

One hundred patients (51.8%) were still using CPAP at the time that they were contacted, though 17 of these patients did not meet the adherence criterion. Twenty-nine patients (15.0%) had used CPAP for a period of time but ultimately discontinued its use. Eighteen patients had stopped CPAP treatment in the first 2 months after commencing this treatment. Sixty-four patients (33.2%) never filled their initial CPAP prescription (see Table 2).

Discussion

Our study demonstrates the CPAP adherence of OSA patients in Tianjin; the results show a dichotomy in CPAP adherence. Approximately one half of our patients, including the patients in Group II, Group III, and the patients who didn't meet the adherence criterion in Group I, were not adherent to CPAP treatment, while others adhered well.

Few studies in English reporting Chinese CPAP adherence were retrieved. We hope this report could add to world knowledge of the important problem of CPAP adherence.

Several studies⁹⁻¹² attempted to identify the factors influencing CPAP adherence. We also tried using the data collected in this survey to discover the influencing factors. In our study, age, sex, AHI, and CPAP pressure are not significantly different among adherent and non-adherent groups and therefore could not be used to predict subse-

quent CPAP adherence. While some studies^{9,10} have noted similar results, others^{11,12} have found that CPAP adherence is related to AHI, sex, or age. The small sample size of our study may have influenced our findings, and a bigger sample could possibly have identified specific factors influencing CPAP adherence.

Approximately half of the subjects were using prescribed CPAP, which is a value similar to that noted by Wolkove et al.¹⁰ Two Chinese retrospective surveys showed the percentages of patients with good CPAP adherence were 56.8%¹³ and 54.3%,¹⁴ respectively, which were also similar to our results. There were, however, still 17.0% of patients who couldn't meet the adherence criterion in Group I in our survey. The patients who had initiated CPAP but eventually abandoned its use accounted for 15.0% of our study population. Yuan et al,¹⁴ in a retrospective investigation, showed there were 28.6% patients who did not persist in using CPAP. de Zeeuw et al estimated that approximately 25% of all patients with OSA would discontinue therapy in long-term follow-up.¹⁵ Their most common reasons were finding CPAP use every night troublesome and difficulty in exhaling or falling asleep. Despite being prescribed CPAP, one third of our study population failed to initiate treatment.

Wolkove et al¹⁰ similarly found that 31% of patients do not commence treatment after PSG diagnosis and CPAP trial, while Li et al¹⁶ reported 32.2%. Our investigation suggests that initial acceptance of CPAP is significantly influenced by the first experience with this treatment during the titration trial. The most common reason for failing to begin therapy given by our patients was that they were unable to adapt to CPAP or sleep well during the titration trial. We concluded that the first CPAP exposure is vital to the acceptance of this treatment for the OSA population, which is supported by Drake et al.¹⁷

Based on the reasons given by the patients for poor CPAP adherence, we proposed the following intervention. First, ensure patient comfort in the titration trial, which is the patient's first exposure to CPAP. In our study up to 46.9% (30/64) of the population failed to initiate treatment because they couldn't acclimatize themselves to CPAP. Drake et al¹⁷ found that the first experience with CPAP would influence the acceptance of CPAP. Therefore, extra efforts should be made to help patients adapt to CPAP and achieve good sleep during the titration trial. Some recent studies suggest specific sedative use during initial CPAP titration,^{18,19} and early CPAP use²⁰ may help facilitate sleep during early acclimation to CPAP and, consequently, improve adherence in the early stage.

Second, enhance patients' education and treatment support, especially in the early days. Up to 30.0% of those with poor adherence (33/110) expressed no perceived need, doubted the benefits of treatment, or found that using CPAP every night was too troublesome. We theorize it is neces-

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Table 2. Sample Characteristics in 3 Groups

	Group I	Group II	Group III	P
Number (%)	100 (51.8)	29 (15.0)	64 (33.2)	NA
Male/female, no.	81/19	24/5	57/7	.30
Age, mean ± SD, y	52.84 ± 10.35	54.28 ± 10.35	49.39 ± 11.92	.07
AHI, mean ± SD, events/h	62.96 ± 19.39	58.15 ± 18.54	56.19 ± 25.23	.13
CPAP, mean ± SD, cm H ₂ O	12.19 ± 3.46	11.91 ± 2.85	11.93 ± 4.06	.88

Table 3. Reasons for Poor Adherence in the 3 Groups

	Group I	Group II	Group III	Total	Percent
Unable to adapt to CPAP or sleep well during titration trial	0	0	30	30	27.3
Troublesome to use CPAP every night	0	8	12	20	18.2
Did not perceive benefit	1	0	12	13	11.8
Noise and discomfort of apparatus	3	4	0	7	6.4
Difficult to exhale and fall asleep	0	7	0	7	6.4
Cumbersome	2	0	4	6	5.5
Unable to afford the device	0	0	6	6	5.5
Got better and no longer need the treatment	2	3	0	5	4.5
Forgot to use	3	0	0	3	2.7
Not satisfied with the treatment	0	3	0	3	2.7
Nasal dryness/sore	1	2	0	3	2.7
Muggy in summer	2	0	0	2	1.8
Sleep disruption by CPAP	2	0	0	2	1.8
Heart attack or transient ischemic attack	1	1	0	2	1.8
Claustrophobia with mask	0	1	0	1	0.9
Total	17	29	64	110	100

sary to reinforce patients' education and support on the CPAP treatment in an attempt to improve their understanding and adherence to CPAP treatment. Wiese et al²¹ suggested that video education was an effective method. Furthermore, quite a number of patients in our survey abandoned the treatment within 2 months of commencement. It is inevitable that patients who had no experience with CPAP will run into problems, such as nasal dryness, when they first start using the devices, which will influence adherence. If interventions, such as home-visit or telephone education, are implemented in the early stage, the problems or confusion about the CPAP use could be solved at this time, favoring good adherence. Karrer et al²² concluded that a sufficient adherence at an early stage usually led to sufficient adherence later on. Smith et al²³ found that patient education combined with music and a habit-promoting intervention can improve OSA patients' adherence to CPAP.

Third, some patients mentioned the machine noise, discomfort of apparatus, or inability to personally afford the device. That implies that there are multiple opportunities for interventions to improve adherence to CPAP therapy. The prices of the CPAP devices are relatively high and the National Medicare Insurance does not cover the CPAP

treatment, so that some lower-income patients in our survey could not afford the equipment and abandoned this treatment. If the National Medicare Insurance would cover it, patients could pay little for CPAP, and then more lower-income patients could benefit from this treatment. All in all, to improve the adherence to CPAP treatment in OSA patients, it will require combined efforts from the physician, sleep technician, sleep nurses, home care nurses, home-medical-equipment provider, the family members, and even the government. As Bollig²⁴ concluded, encouraging CPAP adherence is everybody's job.

Two patients told us they had experienced heart attacks or transient ischemic attacks at the beginning of using CPAP. Lavie et al²⁵ stated that intermittent hypoxia may have a protective effect on the coronary circulation. These 2 cases warrant further investigation.

Among the 210 eligible patients, 11 patients could not be contacted and 6 refused to be interviewed. We do not have the follow-up data on these 17 patients. It is very likely that the 11 patients changed their telephone numbers some time after the titration trial. We cannot infer whether or not they are adherent to CPAP treatment. We think the 6 patients who refused to participate were probably not interested in CPAP treatment and did not adhere well to

CPAP. Hoffstein et al²⁶ suspect that these individuals are less likely to be satisfied with CPAP. If we included these 6 patients, the non-adherent group would account for 58.3% (116/199), slightly more than 57.0% (110/193) of those who interviewed.

A limitation of our study was that it was subjective. The adherence status and the reasons for poor adherence relied on patients' responses to our questions. Rauscher et al²⁷ and Kribbs et al⁸ thought that patients may have falsely reported adherence to CPAP treatment, and most patients tend to overestimate their CPAP adherence. But Rauscher et al²⁷ and Meslier et al²⁸ found that there was a correlation or agreement between the patients' reported CPAP use time and that obtained by objective monitor. Thus, it is conceivable that our adherence rate was actually lower, being close to 51.8% (100/193) or well under it. Due to limited hardware and software resources, it is not practical to objectively verify the patients' CPAP uses. Fang²⁹ pointed out that the advantage of telephone survey is that it can get frank responses. So we can simply report the adherence according to patients' responses.

Conclusions

Adherence to CPAP therapy is low in Tianjin. Approximately one half of our patients remained adherent to the treatment. However, the other half of these patients either never initiated the treatment or had abandoned CPAP use. To improve CPAP adherence, we recommended that the staff should attach more importance to the titration trial to make patients feel comfortable in the first CPAP experience. It is also very important to give the patients more education and support about CPAP use in the follow-up, especially at the initiation of this treatment.

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