Curative Effect of Radiofrequency Ablation on Ineffective Obstructive Sleep Apnea Hypopnea Syndrome after Uvulopalatopharyngoplasty

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Abstract: Objective: To investigate the curative effect of the plasma low-temperature radiofrequency ablation (RFA) on ineffective obstructive sleep apnea hypopnea syndrome (OSAHS) after uvulopalatopharyngoplasty (UPPP). **Method:** 39 cases of OSAHS which were ineffective after UPPP were chosen to accept RFA. Preoperative apnea hypopnea index (AHI), lowest saturation of blood oxygen ($LSaO_2$), snoring scale and Epworth sleepiness scale were compared with those post-operatives to value the curative effect of RFA. **Result:** The effective ratio was 53.8%. In 8 weeks after treatment, epworth sleepiness scale decreased much significantly (<0.01), and there was no difference on snoring scale. In 6 months after operation, lowest saturation of blood oxygen($LSaO_2$) improved significantly ($P<0.05$). In addition, apnea hypopnea index (AHI) decreased significantly (<0.05). **Conclusion:** RFA is an effective remediation treatment to ineffective OSAHS after UPPP.

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Key words: obstructive sleep apnea hypopnea syndrome; radiofrequency ablation

1. Introduction

The uvulopalatopharyngoplasty (UPPP) is one of the most effective methods to treat the obstructive sleep apnea hypopnea syndrome (OSAHS). The pathogenic factors of OSAHS are complicated in association with age, obesity, upper airway paramorphia and internal secretion change. Different upper airway obstructive positions, anatomical features and big individual difference of patients, all result in the poorly curative effect after the UPPP. According to a report, the long-term UPPP curative effect makes up 50% or so generally. This research intends to explore the curative effect of the ineffective OSAHS after UPPP by the plasma low-temperature radiofrequency ablation (RFA).

2. Data and method

2.1 Selection of patients

39 cases of OSAHS which were ineffective after UPPP were chosen to accept RFA, and general conditions for patients see Table 1. All patients were monitored and diagnosed by polysomnography (PSG). Based on the diagnosis standard issued from the Hangzhou Meeting, apnea hypopnea index (AHI) is slight at 5—20, moderate at 21—40, and severe at greater than 40. The oxyhemoglobin saturation ($LSaO_2$) is slight hyoxemia when it is 85% or more, moderate at 65%～84%, and severe at less than 65%. The PSG monitoring results for patients by RFA treatment see Table 2. The obstruction plane is located in palate for 33 cases and/or glossopharyngeal scale for 6 cases. It was exclusive of organic diseases of heart and cerebral vessels such as chronic bronchitis, emphysema, cerebral thrombosis, coronary heart disease and cardiac failure.

Table 1. General conditions for 39 cases

Number of cases（Male/female）	33/6
Body mass index (BMI)	34.3±6.9
Age	39～65 years old
AHI (time per hour)	36.4±7.9
$LSaO_2$ (%)	69.5±9.7
Time after UPPP	8～31 months

Table 2. Patients' PSG monitoring results by RFA treatment

	Slight	Moderate	Severe
AHI (time per hour)	0	24	15
$LSaO_2$ (%)	3	23	13

2.2 Therapeutic method

The radiofrequency ablation (RFA) was available by connecting the one-off Reflex 55 bipolar plasma radiofrequency head with a Coblation RF generation control system (Anthrocare, USA). The patients sat up and gargled with normal saline in operation. After surface anesthesia to the pharyngeal mucous membrane with 1% tetracaine, 2% lidocaine was applied partly for bilateral palatine arch, soft palate, uvula and root of tongue by local infiltration anesthesia. Because patients had received UPPP in advance, bilateral front and back palatine arches were sutured and formed a sole palatine arch on the wound healing surface. The operating energy for the radiofrequency head was regulated at the scale of 5, and the head was dipped with normal saline. According to regional anatomy for every patient, one point was selected on three poles of the upper, middle and low parts of the bilateral palatine arch, and 3—4 therapeutic points were taken on soft palate and uvula. One action point was selected in the middle line at one centimeter away from the root of the upper uvula basement, then cut open around 05cm to the left and the right scalely respectively at the point, and another two action points were select. The needle was inserted in the bevel angle of 30° to mucous membrane surface from the top down at three action points. The thick and long uvula was fixed with an operating forceps, and the RF head was inserted into soft uvula tissue from the bottom up along the end of uvula. The needle was inserted into tissue under mucous membrane around 1.5—1.8cm, then pulled out after 10—15 seconds. In the operation on tongue root, the one third front tongue was wrapped with gauze and pulled out to reveal the tongue root. A small rhombus area at an area of 3×2cm was made at the middle of tongue root, and perforated at a depth of around 2.5cm in its front, back, left, right and middle respectively, and the operation was done for 10—15 seconds in tissue. The patients' aspiration was observed carefully after operation. The patients kept their oral cavity clean by gargling, and were applied intravenous injection with antibiotics plus hormone for three days. They should not have too hot, hard and excitant food in three days after operation. Moreover, they should be checked up periodically at the first, fourth and eighth weeks respectively, and reexamined by PSG in six months after operation.

2.3 Comparative parameters and standard before and after therapy

2.3.1 PSG monitoring parameters AHI and $LSaO_2$ in six months after operation: Based on the requirements of curative effect issued from the Hangzhou Meeting[1], AHI < 5 and SaO_2 > 90%, indicating recovery with symptom disappearing; AHI <20 and its reduction ≥50%, indicating significant effect with symptom disappearing; AHI reduction ≥25%, indicating curative effect with symptom reliving; AHI reduction <25%, indicating ineffective without significant symptom reliving.

2.3.2 Snoring scale[2-5]: the patients' snoring was divided at 0—10 scales within eight weeks after and before operation. Scale 0 for snoring index: no snoring sound; Scale 1—3: slight snoring sound, no disturbing bedfellows for sleeping; Scale 4—6: bigger snoring sound, disturbing bedfellows for sleeping; Scale 7—9: the snoring sound troubling others nearby; Scale 10: no bedfellows living in the same room with the ones who snore severely.

2.3.3 Epworth drowsiness scale [4]: Scaling the Epworth drowsiness within eight weeks before and after operation for patients. Scale items: (1) Sit and read; (2) Watch TV; (3) Sit down in public places (such as cinema and meeting room); (4) Take a vehicle for more than 1 hour; (5) Lie down and have a rest in proper environment; (6) Sit down and have a talk; (7) Sit down and have a rest after dinning (no alcohol drinking); (8) Park and wait by car or driving. Standard for scale: 0 point: no drowsy; 1 point: infrequent; 2 points: possible; 3 points: probable.

2.4 Statistic processing

The SPSS10.0 software was applied for analysis, and all parameters were represented by $\bar{x}\pm s$. the parameters before and after treatment were compared by t test, P<0.05 showing a significant difference, and P<0.01 indicating a very significant difference.

3. Results

According to the requirements of curative effect, there was no curative effect for 18 cases, accounting for 53.8%, and the results see Tables 3 and 4. The snoring scale after 8 week treatment reduced insignificantly compared with prior treatment, while the scale of Epworth drowsiness reduced significantly compared with prior treatment (P<0.01). AHI in six months after treatment reduced much significantly than prior treatment (P<0.05). $LSaO_2$ goes up much obviously than prior treatment (P<0.05). The results see Table 5. It is seen from the results that the curative effect for light OSAHS is better than that of the severe ones. The frequency for sleep apnea and hypopnea reduces significantly after treatment, $LSaO_2$ goes up obviously, and drowsiness is improved significantly, but not so snoring sound.

Table 3. Effect by RFA treatment

Number of cases	Total effective rate	Curing	Significant	Effective	Ineffective
39	21/39(53.8%)	4	6	11	18

Table 4. Effect after RFA treatment

	Number of cases with curative effect after treatment (21/39)		
	Slight	Moderate	Severe
AHI(time per hour)	0	14/24	7/15
$LSaO_2$ (%)	3/3	13/23	5/13

Table 5. Comparative parameters and standard before and after treatment

	AHI(time per hour)	$LSaO_2$ (%)	Snoring scale	Epworth scale
Before treatment	38.4±7.2	69.5±9.2	4.4±1.7	15.3±4.5
After treatment	$25.6±5.9^{*}$	$83.9±6.9^{*}$	3.2±1.9	$6.7±2.2^{**}$

* $P<0.05$ ** $P<0.01$

4. Discussions

Failure of UPPP is caused mainly by mis-operating in soft palate and palatine arch processing. As more mucous membrane of soft palate and front and back palatine arch are dissected, there is greater tension in suture, so that the suture lines come off more early after operation. As a result, obvious scar is left after the wound healing with poor operational curative effect. The soft palate is located in two sides of uvula, and there is a gap between the uvularis attachment and staphylinus externus & levator veli palatini muscle, and it is filled with adipose tissue, called palatine velum gap. At the time of dissecting the palatine velum gap, the muscle group in soft palate should be separated bluntly to the pharynx side to distinguish the dividing line of fat and muscle, reduce damage of muscular tissue, and reserve physiological and anatomical structures of cavum pharyngis to the hilt. The surface of the wound is ensanguined in operation. This will result in unclear dividing line between fat and muscle, and fat in the gap of velum palatinums is not cleaned off thoroughly, which causes the poor curative effect after operation. UPPP only removes palatopharyngeal obstructive plane, but is helpless of pharyngeal obstructive plane. If the palatopharyngeal and pharyngeal obstructive planes exist in airway side by side, pharyngeal obstructive plane becomes the main obstructive plane with the change of pressure in the airway after UPPP removes palatopharyngeal obstructive plane. For this reason, the curative effect after operation is poor or fails.

RFA therapy in OSAHS is concerned widely. Its principle is: the RF energy is generated by bipolar technology to form the plasma lamina on the surface of tissue. As the ions are accelerated by electric field, energy is transmitted to tissue to open molecular bond in low temperature. By this way, the cell is disrupted into carbohydrate and oxides, which results in coagulative necrosis, absorption, ecclasis and forming scar for the local tissue, so as to incise or reduce the volume of tissue. As the charge particle plays its role in the relatively low temperature, surrounding tissues suffers less thermal damage. When the setting energy value is less than the energy threshold value of generating plasma, the resistance of the tissue causes heat effect with hemostasis or tissue shrinkage. Radiofrequency volumetric tissue reduction is just applied to dispose improper re-correction of soft palate and palatine arch in UPPP. Moreover, it can remove the obstructive plane in the tongue root to enlarge the airway area for improvement of curative effect.

The continuous positive airway pressure (CPAP) treatment can prevent effectively apnea and hypopnea occurring in patient sleeping. Currently, it is a major medical therapy which has better curative effect on the vast majority of patients, and is still effective for patients in UPPP failure, especially for those who have poor curative effect in long term and after three years. It is a safe and reliable therapy. Its shortcomings are: it is tedious in therapy because it is worn every day; patient wouldn't like to accept it because of its poor comfort, and part of them can stand the long-term CPAP therapy. The RFA therapy in OSAHS provides a new option for the patients who fail in UPPP and can't stand the long-term poor curative effect, especially poor effect after three years.

The attention to option of adaptation diseases should be paid for RFA therapy to ineffective OSAHS after UPPP. At first, it is determined that the patients still have the obstruction of palatopharyngeal and/or glossopharyngeal part. It is seen from curative effect of patients in the group that light and moderate OSAHS is better than the severe ones in curative effect. Thus, PSG is very important before therapy. The CPAP therapy should the first choice for ineffective severe OSAHS after UPPP, and the RFA therapy is considered finally only for patients with severe OSAHS who can't stand the long-term CPAP therapy.

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