

Postoperative Pain and Wound Healing After Coblation-Assisted Barbed Anterior Pharyngoplasty (CABAPh): An Observational Study

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Abstract Despite the numerous progresses in the palatal surgery, one of the critical aspect of snoring and OSA surgery is the postoperative pain. Over the last decades several surgical palatal procedures have been proposed. Our aim was to evaluate the tolerability of the coblation-assisted barbed anterior pharyngoplasty (CABAPh) in terms of postoperative pain and wound healing, compared with bipolar assisted barbed anterior pharyngoplasty (BAPh). An observational study on 20 patients with simple snoring was conducted. The outcomes measured to assessing pain were a 10 cm visual analog scale (VAS) and the dose of paracetamol + codeine administrated postoperatively. The wound healing was evaluated using a 3-point scale. The other parameters indicative of both pain and surgical repair were food intake and weight loss postoperatively. The mean overall pain (VAS scale) was significantly less in the CABAPh group (M 3.7; CI 3.34–4.06) compared with the BAPh (M 4.73; CI 4.28–5.19) with a $P = 0.003$. The mean wound healing after 4 weeks was significantly less in CABAPh group (M 2.7; CI 3.12–2.28) compared with the BAPh (M 2.1; CI 2.45–1.75) with a $P = 0.02$. There were no statistically significant difference with regard to food intake ($P = 0.09$) and weight loss

($P = 0.94$). The CABAPh was able to achieve a greater pain reduction and a faster wound healing compared with bipolar forceps.

Keywords Coblator · Anterior pharyngoplasty · Pain · Wound healing · Barbed

Introduction

Snoring and obstructive sleep apnea syndrome (OSAS) are common disorders affecting respectively at least 40 to 50% and 2% to 4% of adult population characterized by repeated episodes of vibration and collapse of the pharyngeal airway during sleep resulting in: noise production (snoring), airflow cessations, oxygen desaturations, fragmentation of sleep, daytime sleepiness [1, 2]. The retropalatal region is considered the most common site of vibration and obstruction in patients with snoring and OSA syndrome [3, 4].

Over the last decades several surgical palatal procedures have been proposed, mainly aimed at improving airway patency by removing redundant tissues and/or creating scar tissue to incite fibrosis and stiffen the palate [5–9]. In 2007 Pang and Terris [10] described the modified cautery-assisted palatal stiffening operation (CAPSO), later evolved in the anterior palatoplasty or pharyngoplasty (APh); according to the authors, this technique has been shown to be effective in the management of patients with simple snoring and mild-moderate OSA. Even other authors have reported the same encouraging experience with the AP in terms of morbidity and patient satisfaction when compared with other techniques [11–13, 18].

We were the first to conceive the reversible and non-resective palatopharyngeal surgical lifting and suspension

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technique (otherwise known as the ‘Roman blinds technique’) with normal sutures, and used it to treat a selected series of OSA patients [2, 14]. We concluded that the only reasonable therapeutic course was to increase the basal stiffness of the palatopharyngeal district by tensioning and anchoring its muscle structures to the surrounding bones (spina nasalis posterior; hamuli pterygoidei) and ligaments (pterygomandibular raphe), while preserving their contractile activity [15]. This innovative approach was further refined with the introduction of the new suturing technology of barbed sutures (BS), which were first used within oral and pharyngeal tissue. We subsequently adopted modular barbed snore surgery (MBSS), nowadays evolved in the more comprehensive modular barbed snoring OSAHS surgery (MBSOS[®]) devised by M.M., L.P., V.R., which customizes the most suitable structural modifications for correcting pathological UA collapsibility on the basis of the individual anatomical findings of drug-induced sleep endoscopy (DISE) [16].

In the last 10 years, coblator has get a widespread use in ENT surgery and especially in oropharyngeal surgery (e.g. tonsillectomy and tongue base resection); its use has also been reported for uvulopalatoplasty [17] with brilliant outcomes.

In this paper we report our preliminary experience with coblation-assisted barbed anterior pharyngoplasty (CABAPh). The purpose of the study was to evaluate the tolerability of the CABAPh in terms of postoperative pain and wound healing, compared with bipolar-assisted barbed anterior pharyngoplasty (BAPh) [18].

Materials and Methods

The present study is an unfounded study, with no monetary support from any source, conducted at the Fondazione I.R.C.C.S. Ca’ Granda, Ospedale Maggiore Policlinico of Milan and Campus Bio-Medico University of Rome (Italy). All procedures were carried out in accordance with the principles of Helsinki Declaration and informed consent was obtained from all patients before including them in the study.

A total of twenty consecutive adult patients with primary snoring were included. All of them underwent a pre-operative complete workup, including thorough medical history, a complete ENT examination including fiberoptic nasopharyngolaryngoscopy with Muller maneuver and overnight polysomnography.

Inclusion criteria for this study were: simple snoring or mild obstructive sleep apnea syndrome (AHI < 15/h), age > 18 years, previous tonsillectomy. Exclusion criteria comprised: cardio-vascular or chronic respiratory disease, diabetes, hematological disorders or coagulopathies,

neurological disorders, regular use of analgesia, regular use of steroids. In addition, the appropriate surgical indication for BAPh required a thick and ptotic palate, palatal tonsils size 0–1 according Brodsky and a retropalatal site of collapse with antero-posterior pattern assessed through DISE.

Surgical Technique (Barbed Anterior Pharyngoplasty)

Anterior palatoplasty was performed in a slightly different way compared to the original technique described by Pang and Terris. In fact all the procedures were performed under general anesthesia and no surgical step on the uvula was carried out.

Step 1: Removal, using cold blade (BAPh) or coblator (CABAPh), of a semilunar strip of palatal mucosa (made of epithelium, submucosa, minor salivary glands) in order to expose the oral surface of the palatal muscular layer. Emostasis was obtained with bipolar forceps (BAPh) or coblator (CABAPh).

Step 2: One of the two needles of the bidirectional barbed suture (2–0, PDO) pierces the oral mucosa overlying the posterior nasal spine and, travelling through the palate periosteum and aponeurosis, comes out through the oral mucosa at the junction of the posterior tonsillar pillar with the uvular base.

Step 3: The needle reenters the previous mucosal hole to encircle the upper extremity of the palato-pharyngeus muscle and reaches the paramedian anterior border of the semilunar palatal wound. Here the needle pierces orthogonally, according an “in and out” modality, the muscular fibers of the palate embracing them for 3–5 mm and repeats the same procedure on the facing palatal muscle along the posterior border of the semilunar gap in order to plicate the muscular layer itself. The maneuver has to be repeated two or three times proceeding from medial to lateral in order to complete the plicature of the whole lateral extension of the muscular layer.

Step 4: The needle is then driven submucosally toward the pterygoid hamulus to embrace it and create an antero-lateral pulling vector apt to stiffen and tense the soft palate.

Step 5: In order to strengthen the closure of the semilunar palatal wound the needle is driven submucosally to reach its lateral extremity and then horizontally from lateral to medial to create a running submucosal suture. Eventually the needle must be directed forward to come out from the oral mucosa through the initial mucosal hole at the level of the posterior nasal spine.

Step 6: The same procedure has to be repeated in a mirror fashion on the opposite side utilizing the second half of the bidirectional barbed suture.

Pain and Wound Healing Assessment

The main parameter considered in this study was the evaluation of postoperative pain. A 10 cm visual analog scale (VAS), ranging from “no pain” to “unbearable pain” was used for measuring pain intensity postoperatively. $VAS \geq 6$ was considered as severe pain. The postoperative pain was analyzed by comparing it between both groups during a 3-week postoperative period. As also done by other authors (Belloso A. et al. [17]), we considered that the early postoperative pain (first week) represents the surgical tissue damage, and the second and third weeks (late postoperative pain) represent healing differences secondary to thermal tissue damage.

The dose of paracetamol + codeine administrated postoperatively was recorded at each study time point as total number of doses per week, considering three per day the maximum dose permitted.

The patients were asked to complete a weekly form about the pain-VAS and the total doses of paracetamol + codeine taken during the previous week.

Completion of wound healing was assessed in the postoperative controls at 2, 3, 4 weeks and 2 months. We did not evaluate this parameter at the first week after surgery, because the processes of tissue repair after surgery were still underway. We assigned 3 points in case of complete surgical repair, 2 in case of partial repair and 1 point in case of uncomplete surgical repair, with stitches extruded.

The other parameters indicative of both pain and surgical repair are the diet and weight loss. We asked patients when they were able to achieve a normal food intake after surgery (days) and if they had weight loss (kg).

Statistical Analysis

The results were collected and stored in a Microsoft Excel spreadsheet. Statistical analyses were performed using the statistical package STATA version 13 (StataCorp LP, College Station, TX, USA). Graphs were prepared using *GraphPad Prism* 6.0 for MacBook Air (GraphPad, La Jolla, CA). The results are expressed as mean and 95% confidence interval. The data were analyzed using non parametric Mann–Whitney test to compare the independent groups. Statistical significance was defined at $P < 0.05$.

Results

The study comprised 20 patients (17 men and 3 women) with a mean age of 52.9 ± 9.15 years (range 32–64) and a mean body mass index (BMI) of 25.2 ± 2.83 , with no statistically significant difference between groups ($P = 0.22$; $P = 0.45$). The twenty patients included presented a simple snoring (apnea–hypopnea index AHI < 5). Ten patients underwent anterior pharyngoplasty with CABAPh technique and ten of them with BAPh. No complications or bleeding were detected during the postoperative period in both groups.

The mean overall pain (VAS scale) was significantly less in the CABAPh group (M 3.7; CI 3.34–4.06) compared with the BAPh (M 4.73; CI 4.28–5.19) with a $P = 0.003$.

The average early postoperative pain (VAS scale) was less in CABAPh group (M 7.3; CI 6.37–8.23) compared with the BAPh (M 8; CI 7.17–8.83), but not statistically significant ($P = 0.28$). Similarly in the second and third weeks, the mean late postoperative pain was less in CABAPh group (2 week, M 2.6; 3 week, M 1.2) compared with the BAPh (M 2 week: 4.0; M 3 week: 2.2) with no statistically significant difference (2 week, $P = 0.06$; 3 week, $P = 0.05$) (Fig. 1).

For the use of analgesia, as expected, the results correlated with the patient’s pain scores. The doses of analgesia consumed by CABAPh group were inferior during each week compared to the BAPh group but the differences were not statistically significant. (TABLE 1).

The average wound healing after 2 and 3 weeks was greater in CABAPh group (2 week, M 1.5; 3 week, M 2.3) compared with BAPh (2 week, M 1.4; 3 week, M 1.7), but not statistically significant (2 week, $P = 0.67$; 3 week, $P = 0.12$). The mean wound healing after 4 weeks was significantly higher in CABAPh group (M 2.7; CI 3.12–2.28) compared with the BAPh (M 2.1; CI 2.45–1.75) with a $P = 0.02$ (Fig. 2). After 2 months all patients, in both groups, achieved a complete wound healing and recovery.

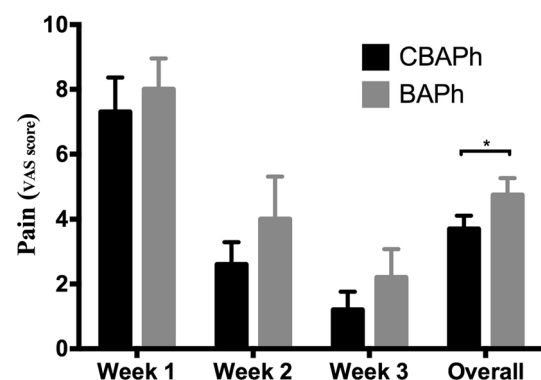


Fig. 1 Post-operative pain measured using a 10 cm visual analog scale (VAS) during a 3-week postoperative period

Table 1 Doses of paracetamol + codeine assumed by each group during the first 3 weeks postoperatively

	1 week CABAPh	1 week BAPh	2 week CABAPh	2 week BAPh	3 week CABAPh	3 week BAPh
M	17.4	18.8	9.1	12.3	1.8	2.6
SD	2.5	2.25	5.19	4.64	1.34	1.95
CI	15.85–18.95	17.4–20.2	5.88–12.32	9.42–15.18	0.93–3.20	1.39–3.81
P	0.17		0.18		0.5	

M mean values; SD standard deviation; CI confidence interval; P p value

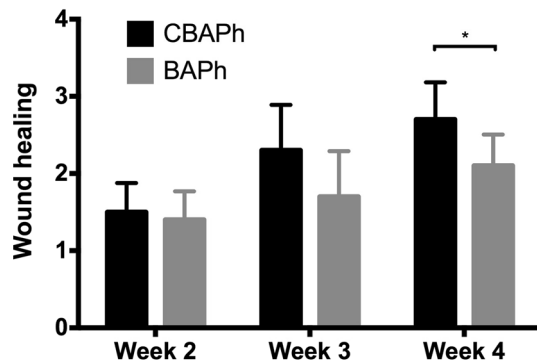


Fig. 2 Wound healing measured using a 3-point scale at 2, 3, 4 weeks postoperatively

The CABAPh group was able to achieve a normal food intake after 1.9 days postoperatively (CI 1.55–2.25), while the BAPh restored a normal food intake after 2.5 days (CI 1.97–3.03), and no statistically significant difference was calculated ($P = 0.09$). Accordingly, the average weight loss was similar between the two groups with no statistically significant difference (CABAPh, 2.8 kg; BAPh, 2.9 kg; $P = 0.94$).

Discussion

Despite the numerous progresses in the palatal surgery, one of the critical aspect of snoring and OSA surgery is the postoperative pain, which makes the patient reluctant to undergo surgery. Uvulopalatoplasty is commonly associated with high postoperative morbidity with severe postoperative odynophagia and most patients experience some degree of weight loss [19]. In addition, patients experience a severe throat pain for an average of 8–14 days. Various authors suggested that the postoperative pain is mainly due to the direct surgical injury to the tissues, such as mucosa and muscle. The palate/pharyngeal mucosa has profuse tactile and pain innervations and consequently is prone to considerable discomfort.

Despite the belief that all of these surgeries lead to severe postoperative pain, the intensity of pain varies

according to different techniques [20, 21]. Between the various palatal procedures, AP is reported to be less painful if compared with other operations such as uvulopalatal flap and lateral pharyngoplasty [22]. Because of the discouraging long-term surgical results and relatively high prevalence of complications, surgeons tend to propose less aggressive and more tolerable surgical options [19].

Plasma-mediated radio-frequency-based ablation (coblation) creates a precisely focused plasma that dissociates molecular bonds within the contact area at relatively low temperatures (40–70 °C); this results in the volumetric removal of target tissue and, in contrast to other electro-surgery techniques, decreased hyperthermic cytotoxicity. In several ENT procedures (e.g. tonsillectomy), coblation is reported to be associated with less postoperative pain if compared with traditional technique; this has been explained with the minimal collateral thermal tissue damage induced by coblation [23, 24].

Our preliminary data suggest that CABAPh is associated with low postoperative pain and odynophagia. As a consequence, all the patients returned to oral diet the same day of the operation and the majority (80%) achieved a normal food intake 3 days after surgery.

The second critical aspect in OSA palatal surgery is the cicatrization. Delayed healing is a common finding after palatal surgery for snoring and OSA: few days after surgery the wound sutures tend to dissolve leaving a thick layer of fibrin that will ensure healing by secondary intention in 10–14 days. The delayed healing is reported to be mainly due to surgical methods (such as diathermy or laser) producing extreme temperatures and extensive collateral thermal tissue damage. The reported advantage of coblation is the faster tissue healing and consequently decreased postoperative discomfort, as confirmed by our study in which wound healing was faster in the CABAPh group, particularly after one month postoperatively. This observation has been demonstrated in several medical publications evaluating the postoperative complications rates and pain between coblation and diathermy tonsillectomy [25]. With regard to this comparison, many authors published data about the rate of primary and secondary hemorrhage in coblation versus standard techniques [26]. None of our

patients had bleeding after surgery. Regardless, we consider this report non-significant, because the surgical breach is small and tissues are not altered by repeated inflammatory processes as in the case of tonsils, thus the risk of bleeding is lower.

The main limitation of the study is the restricted number of patients enrolled. Although the CABAPh group was better according to all outcomes measured, only certain comparisons were statistically significant. Furthermore, the absence of significance relating to food intake and weight loss between two groups could be probably explained by the minimally invasive surgery (Roman blind technique) equally proposed in both groups, other than small sample: patients discomfort was tolerable regardless the device used.

Conclusion

In addition to snoring and OSA improvement, the palatal surgery main purpose is to reduce patient post-operative discomfort. The BAPh is itself a minimally invasive surgery thanks to the preservation of the oropharyngeal fibromuscular structures. Our results suggest that the coblator could allow a further post-operative pain reduction and a faster wound healing with a comprehensive reduction of patient discomfort. Further studies are needed to confirm our optimistic data with a greater sample and by comparing coblator with more electrosurgery techniques.

References

- Casale M, Pappacena M, Rinaldi V, Bressi F, Baptista P, Salvinnelli F (2009) Obstructive sleep apnea syndrome: from phenotype to genetic basis. *Curr Genomics* 10(2):119–126
- Mantovani M, Minetti A, Torretta S, Pincherle A, Tassone G, Pignataro L (2012) The velo-uvulo-pharyngeal lift or “roman blinds” technique for treatment of snoring: a preliminary report. *Acta Otorhinolaryngol Ital* 32(1):48–53
- Vicini C, De Vito A, Benazzo M et al (2012) The nose oropharynx hypopharynx and larynx (NOHL) classification: a new system of diagnostic standardized examination for OSAHS patients. *Eur Arch Otorhinolaryngol* 269(4):1297–1300
- Kezirian EJ, Hohenhorst W, de Vries N (2011) Drug-induced sleep endoscopy: the VOTE classification. *Eur Arch Otorhinolaryngol* 268(8):1233–1236
- Fujita S, Conway W, Zorick F, Roth T (1981) Surgical correction of anatomic abnormalities in obstructive sleep apnea syndrome: uvulopalatopharyngoplasty. *Otolaryngol Head Neck Surg* 89(6):923–934
- Woodson BT, Robinson S, Lim HJ (2005) Transpalatal advancement pharyngoplasty outcomes compared with uvulopalatopharyngoplasty. *Otolaryngol Head Neck Surg* 133(2):211–217
- Ellis PD (1994) Laser palatoplasty for snoring due to palatal flutter: a further report. *Clin Otolaryngol Allied Sci* 19(4):350–351
- Mair EA, Day RH (2000) Cautery-assisted palatal stiffening operation. *Otolaryngol Head Neck Surg* 122(4):547–556
- Wassmuth Z, Mair E, Loube D, Leonard D (2000) Cautery-assisted palatal stiffening operation for the treatment of obstructive sleep apnea syndrome. *Otolaryngol Head Neck Surg* 123(1 Pt 1):55–60
- Pang KP, Terris DJ (2007) Modified cautery-assisted palatal stiffening operation: new method for treating snoring and mild obstructive sleep apnea. *Otolaryngol Head Neck Surg* 136(5):823–826
- Binar M, Karakoc O (2018) Anterior palatoplasty for obstructive sleep apnea: a systematic review and meta-analysis. *Otolaryngol Head Neck Surg* 158(3):443–449
- Pang KP, Pang EB, Pang KA, Rotenberg B (2018) Anterior palatoplasty in the treatment of obstructive sleep apnoea - a systemic review. *Acta Otorhinolaryngol Ital* 38(1):1–6
- Marzetti A, Tedaldi M, Passali FM (2013) Preliminary findings from our experience in anterior palatoplasty for the treatment of obstructive sleep apnea. *Clin Exp Otorhinolaryngol* 6(1):18–22
- Mantovani M, Minetti A, Torretta S, Pincherle A, Tassone G, Pignataro L (2013) The, “Barbed Roman Blinds” technique: a step forward. *Acta Otorhinolaryngol Ital* 33(2):128
- Mantovani M, Rinaldi V, Torretta S, Carioli D, Salamanca F, Pignataro L (2016) Barbed Roman blinds technique for the treatment of obstructive sleep apnea: how we do it? *Eur Arch Otorhinolaryngol* 273(2):517–523
- Mantovani M, Carioli D, Torretta S, Rinaldi V, Ibba T, Pignataro L (2017) Barbed snore surgery for concentric collapse at the velum: the Alianza technique. *J Craniomaxillofac Surg* 45(11):1794–1800
- Bellosio A, Morar P, Tahery J, Saravanan K, Nigam A, Timms MS (2006) Randomized-controlled study comparing post-operative pain between coblation palatoplasty and laser palatoplasty. *Clin Otolaryngol* 31(2):138–143
- Salamanca F, Costantini F, Mantovani M et al (2014) Barbed anterior pharyngoplasty: an evolution of anterior palatoplasty. *Acta Otorhinolaryngol Ital* 34(6):434–438
- Mantovani M, Rinaldi V, Salamanca F et al (2015) Should we stop performing uvulopalatopharyngoplasty? *Indian J Otolaryngol Head Neck Surg* 67(Suppl 1):161–162
- Walker RP, Grigg-Damberger MM, Gopalsami C (1997) Uvulopalatopharyngoplasty versus laser-assisted uvulopalatoplasty for the treatment of obstructive sleep apnea. *Laryngoscope* 107(1):76–82
- Osman EZ, Osborne JE, Hill PD, Lee BW, Hammad Z (2000) Uvulopalatopharyngoplasty versus laser assisted uvulopalatoplasty for the treatment of snoring: an objective randomised clinical trial. *Clin Otolaryngol Allied Sci* 25(4):305–310
- Ugur KS, Kurtaran H, Ark N, Kizilbulut G, Yuksel A, Gunduz M (2013) Comparing anterior palatoplasty and modified uvulopalatopharyngoplasty for primary snoring patients: preliminary results. *B-ENT* 9(4):285–291
- Pynnonen M, Brinkmeier JV, Thorne MC, Chong LY, Burton MJ (2017) Coblation versus other surgical techniques for tonsillectomy. *Cochrane Database Syst Rev* 8:CD004619
- Wiltshire D, Cronin M, Lintern N et al (2018) The debate continues: a prospective, randomised, single-blind study comparing Coblation and bipolar tonsillectomy techniques. *J Laryngol Otol* 132(3):240–245
- Mitic S, Tvinnereim M, Lie E, Saltyte BJ (2007) A pilot randomized controlled trial of coblation tonsillectomy versus dissection tonsillectomy with bipolar diathermy haemostasis. *Clin Otolaryngol* 32(4):261–267

26. Glade RS, Pearson SE, Zalzal GH, Choi SS (2006) Coblation adenotonsillectomy: an improvement over electrocautery technique? *Otolaryngol Head Neck Surg* 134(5):852–855

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