

Barbed Reposition Pharyngoplasty in Indian Population: A New Palatal Surgery for OSAS

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Received: 13 February 2018 / Accepted: 24 March 2018 / Published online: 24 April 2018
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Abstract Obstructive sleep apnoea (OSA) is a common problem affecting almost 4% of the population. Although continuous positive airway pressure (CPAP) is considered the standard of care, the patient compliance for long term use is poor. Clinicians have explored surgical options for cure with varying success. Uvulopalatopharyngoplasty was considered as a standard of surgical care but long-term results were not satisfactory. Surgical researchers have explored newer techniques to improve outcomes in the past decade with less morbidity and better quality of life outcomes. One of such development is Barbed Reposition Pharyngoplasty (BRP). We would like to discuss the technique of BRP for OSA patients step by step.

Keywords Obstructive sleep apnoea · Uvulopalatopharyngoplasty · Expansion sphincter pharyngoplasty · Barbed Reposition Pharyngoplasty

Introduction

Successful surgical treatment for OSA (Obstructive sleep apnoea) is a big challenge. With myriad of surgical techniques to address the upper airway in patients suffering from Sleep disordered breathing (SDB), there is a no consensus regarding the ideal procedure to improve the success rate with least morbidity. Previous surgical techniques for OSA were mainly focussed on excision of tissues and shortening the soft palate. In 1981, Fujita et al. [1] introduced Uvulopalatopharyngoplasty (UPPP). It is one of the most commonly performed surgeries in patients suffering from snoring and OSA. Long term results of UPPP were rather disappointing and many surgeons started adapting newer techniques to address the palate for OSA patients. For example, Lateral pharyngoplasty as described by Cahali [2] or Expansion sphincter pharyngoplasty (ESP) as described by Pang and Woodson [3] or Z-Palatoplasty as described by Friedman et al. [4] are popular. Most of these procedures involved extensive suturing and knots to keep the palate in the new position.

A new palatal procedure using *Barbed suture* was described in 2015 by Prof Claudio Vicini [5] inspired by two different techniques described by Montavani [6] and Hsueh-Yu Li [7]. The advantage of this technique is that the palate is repositioned without knots. This has not been reported in the Indian population and we share our initial experience from a tertiary referral centre in India.

Method

This pilot study was conducted at department of ENT, People Tree Hospitals, Bangalore. Patients reporting with symptoms of suspected OSA were asked to fill the STOP-

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BANG or Epworth sleepiness questionnaire. Careful history and ENT examination were done to assess the status of the airway. Patients with BMI above 30 were sent to the dieticians for a care plan to reduce weight and for CPAP trial. Those patients with BMI below 30 were considered for surgery after counselling regarding non-surgical treatment options (CPAP and Mandibular advancement device). All the patients who opted for surgical treatment underwent medical evaluation for co-morbidities (Hypothyroidism, Hypertension and Diabetes mellitus) and a dietician help was sought to counsel regarding weight reduction and healthy lifestyle.

Barbed Reposition Pharyngoplasty (BRP) was done in three patients as a part of pilot study at our institution. All the three patients had moderate to severe OSA with BMI < 30 kg/m² and had declined to use a CPAP machine. Drug Induced Sleep Endoscopy (DISE) was done in all the three patients, prior to surgery and the site of obstruction was found to be at the level of retropalatal region. Nasal surgeries including Septoplasty (1) and Turbinoplasty (2) were performed in all the cases as a part of multilevel surgery.

The findings of DISE were discussed with the patient and surgery was planned. All procedures were done under general anaesthesia with oral flexometallic endotracheal tube intubation. Once the patient was intubated, positioning was done with neck extension. Boyle Davis mouth gag was used for gaining access to the Oropharynx. Pre-surgical antero-posterior distance and distance between lateral pharyngeal walls were measured and recorded to compare pre-operative oropharyngeal space with post-operative diameter.

Using Bipolar cautery and cold steel instruments, bilateral tonsillectomy was done. We prefer to tie the lower pole of the tonsils with 2–0 silk thread. While doing tonsillectomy, the key point is, to preserve the Tonsillar pillars (Palatoglossus and Palatopharyngeus) in their entirety; this is later used for suturing with barbed suture in the next steps. If the patient has already undergone tonsillectomy surgery, the mucosa of the tonsillar fossa is removed, preserving the pillars. Once the tonsillectomy is done, the pathway in which the barbed suture has to be passed, is marked using a marking pen. Pterygomandibular raphe is a thick palpable structure which passes from the Pterygoid

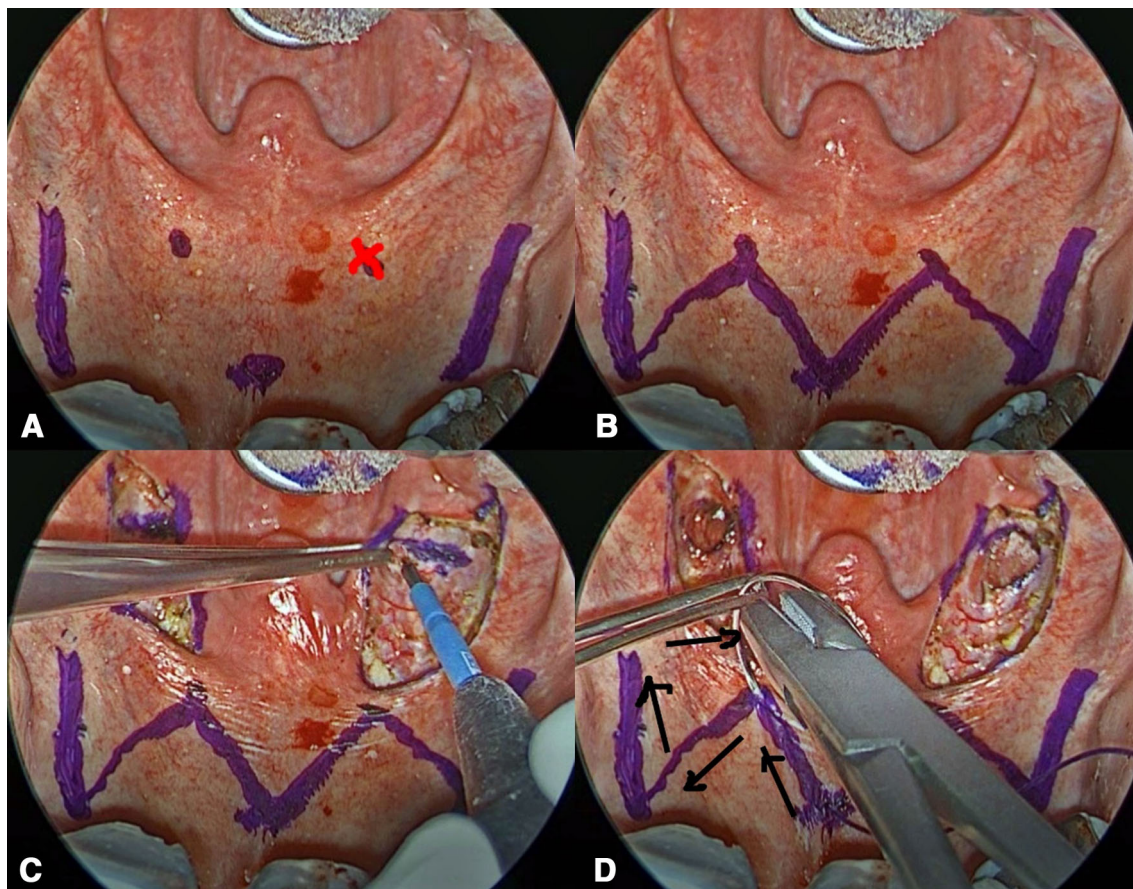


Fig. 1 **a** Marking of posterior nasal spine, bilateral Pterygomandibular raphe and midpoints (X) done. **b** All the marked lines and dots are connected in a zig zag pattern. **c** Weakening of Palatopharyngeus

muscle done using monopolar needle cautery. **d** First bite taken from the posterior nasal spine to midpoint (X)

hamulus to the mandible. This structure is felt and marked for further suturing. The cornerstone of this BRP surgery is to stabilise the Palatopharyngeus muscle on to the Pterygomandibular raphe by using barbed suture. This opens up the space in both antero-posterior and lateral directions and in turn reduces the collapse. We use 2–0 re-absorbable Polydioxanone with tapering needles and barbed bidirectional sutures (Stratafix, Ethicon). The main advantage of using barbed sutures is the knotless technique and ease of suturing.

The technique of marking is done sequentially with first, identifying the posterior nasal spine (Fig. 1a) by palpating the junction between the hard and soft palates and then marking that point in the midline. Pterygomandibular raphe, on both sides are marked after palpation. The third important landmark is the intermediate point(x) approximately midway between the raphe and midline of soft palate. This third point is also approximately midway between the junction of the hard and soft palates and free edge of the soft palate. Now the dots have to be connected to create a jig jag pattern which is symmetrical on the palate (Fig. 1b).

The tonsillar fossa is addressed by marking a level on the Palatopharyngeus muscle approximately at the junction of upper 2/3rd and lower 1/3rd. Using a needle with monopolar cautery, the Palatopharyngeus muscle is weakened and not completely cut (Fig. 1c). Once the Palatopharyngeus is weakened, it is held with non-toothed forceps and pulled laterally and superiorly, to check the extent to which it can be pulled supero-laterally. Then the squaring of the soft palate can be done by removing a part of Palatoglossus and supra-tonsillar fat pad.

A long sturdy needle holder is required to handle the needle of the barbed suture in the Oropharynx. Suturing is started in the midline at the posterior nasal spine (Fig. 1d). The suture should pass through the muscular plane and not in the submucosal plane. Care is taken not to take the bites too deep in the soft palate as the suture can get exposed in the nasopharynx. Once the needle comes out of the mid-point (x), the barbed suture is pulled continuously until it stops spontaneously, where the direction of the barbs change at the centre of the suture material. The needle is then inserted at the same exact point where it came out so that all the suture material is completely buried and not

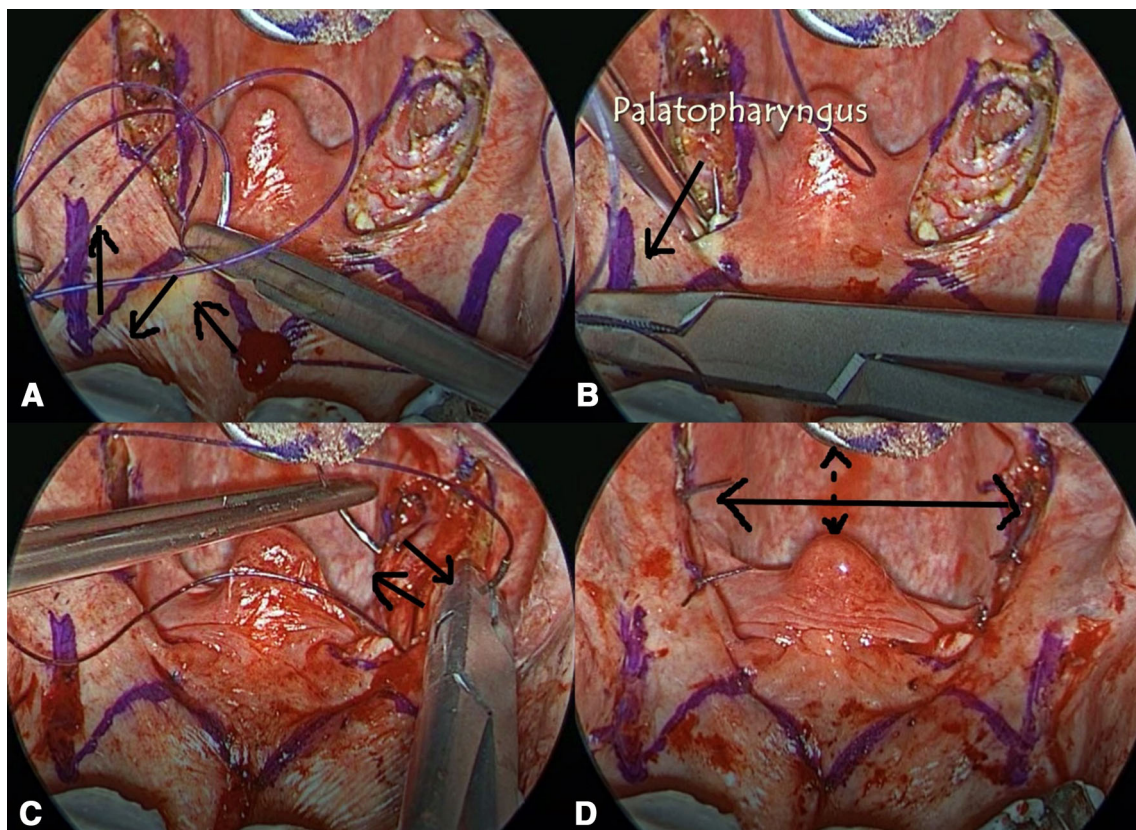


Fig. 2 **a** The second bite is taken from midpoint (x) and the needle comes out lateral to the Pterygomandibular raphe. **b** From the lateral point to Pterygomandibular raphe, needle is brought out through the upper pole of tonsillar fossa. **c** Bites taken through the bulk of Palatopharyngeus muscle from lateral to medial direction sparing the

mucosa. **d** Final appearance after Barbed Reposition Pharyngoplasty surgery

exposed. From the midpoint on the soft palate another bite is taken coming out lateral to the Pterygomandibular raphe (Fig. 2a).

Then the needle is inserted lateral to the raphe and comes out through the upper pole of the tonsillar fossa (Fig. 2b). Once the suture is out of the tonsillar fossa, gentle traction is applied to pull the suture, making sure it is not loose. Now the Palatopharyngeal muscle bites are taken from lateral to medial direction sparing the mucosa (Fig. 2c). The bites have to be thick through the muscle and can be multiple to prevent the tear of the muscle later. Once the Palatopharyngeus muscle is taken through the barbed suture, the needle is passed back through the upper pole of the tonsillar fossa in a superolateral direction so that it comes out lateral to the Pterygomandibular raphe. Once this step is completed, it can be taken back on to the soft palate until the midline, without exposing the suture material.

The same steps can be repeated on the opposite side to get a symmetrical widening of the retropalatal region. It is important, not to pull too much while cutting off the remaining suture material or else it will tear the soft palate. Once the procedure is done and both ends of the barbed suture are cut, check for haemostasis (Fig. 2d). It is better to be vigilant while using bipolar cautery during the whole procedure as it can damage the barbed suture if applied directly on it.

Then a small window is made on the anterior aspect of the base of the uvula using monopolar cautery and the musculus uvulae is cauterised using bipolar cautery, which turns the uvula anteriorly. Later suturing of the window is done using 3–0 Vicryl. We prefer not to remove the Uvula. After thorough suctioning of the nasopharynx and hypopharynx, Patient can be extubated and kept under observation for 4 h in the post-operative ward. Patient is advised to take liquid diet for the first 24 h and soft diet for the next 2 weeks. Normal diet can be started after 2 weeks (Fig. 3).

We give 1 g Paracetamol TID for 5–7 days for analgesia and if the pain is severe, we add Ibuprofen for break-through pain. Patient is advised to do Betadine gargles thrice daily for a couple of weeks.

At 4 months follow up all the patient's reported reduction in snoring and improved quality of sleep. There were no complications. They will be further evaluated with post-operative sleep study at 6 months.

Discussion

The causes of OSA are multifactorial and obstruction is usually multilevel. Palate is the most common site of obstruction. Barbed Reposition Pharyngoplasty is a safe



Fig. 3 Post-operative pictures after 1 week, 1 month and 3 months

palatal procedure which is technically easy to learn and has shown good results (Table 1) in improving the quality of life in patients suffering from snoring and OSAS.

The advantages of this technique are-

- The anterior anchorage of the barbed suture is to an anatomical structure that is more stable, easily palpable and fibrous Pterygomandibular raphe instead of the weaker Palatoglossus muscle.
- The repositioned muscle is the Palatopharyngeus muscle. After a preliminary inferior partial myotomy it is repositioned into more lateral and anterior location without any significant tension.
- The bidirectional nature of the re-absorbable sutures with knotless technology allows running more thread loops around the muscle, creating a sort of dense net,

Table 1 Comparison of pre-operative and post-operative AHI with success rates in various studies

Study	Number of patients	Mean pre-operative AHI	Mean post-operative AHI	Success rate (%)
Vicini et al. [5]	10	43.65	13.57	90
Cammarato et al. [9]	10	34	13.53	90
F Montecvecchi [10]	111	33.4	13.5	73

for a better distribution of the repositioning forces over the muscles.

- Compared to the traditional UPPP or other modifications, the tip of Uvula is not trimmed, but a mucosal island is removed from its anterior aspect. After suturing of the mucosal gap the uvula is just bent forward, leaving intact the posterior surface. This reduces the risk of post-operative foreign body sensation.

Emerging data from various centres around the world has shown encouraging results. In a study by Rashwan et al. [8], the results of BRP, ESP and UPPP were compared in single level obstruction patients and data suggests that BRP results were similar to Expansion sphincter pharyngoplasty (ESP) and significantly better than UPPP. Furthermore a multicentre study was done recently by Cammaroto et al. [9] in patients who underwent 3 different palatal procedures i.e. ESP, BRP and UPPP along with Trans Oral Robotic Surgery (TORS) for snoring and OSA. TORS was done in all the patients in these 3 groups. The AHI was found to decrease significantly in the ESP and BRP groups compared with UPPP group.

The main disadvantage of the technique as we see it is the cost of suture which is five times more than the Vicryl stitches used traditionally. Partial extrusion of the barbed suture was a common complication according to a multicentre study done by Montecvecchi et al. [10]. The passing of the barbed suture requires practice and may sometimes be difficult in short necked individuals with high Friedman palatal scores. Preliminary results from India seem very promising in terms of efficacy and safety. Further studies are needed in the Indian subcontinent to clearly establish this as the procedure of choice for obstructive sleep apnoea.

Compliance with Ethical Standards

Conflict of interest All authors involved in this study have declared that they have no conflict of interest.

Informed Consent The procedures performed on all the patients in this study were in accordance with the ethical standards of the institution. The procedures were performed after obtaining ethical committee approval. Proper written and informed consents were taken from the patients.

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