

Barbed stitch reposition pharyngoplasty as a surgical treatment for sleep apnea patients

Faryngoplastyka repozycyjna z zastosowaniem szwów bezwężłowych jako metoda chirurgicznego leczenia pacjentów z zespołem obturacyjnych bezdechów podczas snu

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ABSTRACT:

Introduction: Surgical methods for obstructive sleep apnea syndrome play an increasingly important role. The development of surgical techniques makes the procedure less invasive, achieves better treatment results, and has a greater possibility of restoring the normal function of the upper airway. One of the sleep surgery for obstructive sleep apnea syndrome is pharyngoplasty. Barbed Stitch Reposition Pharyngoplasty is a relatively new surgical technique introduced in 2012.

Aim: Description of Barbed Stitch Reposition Pharyngoplasty, indications, and contraindications for this procedure as well as the risk of complications and a success rate.

Material and method: A literature review and own experience were conducted in the PubMed database, from 2012–2023, on the surgical technique, e.g. Barbed Stitch Reposition Pharyngoplasty.

Results: A significant decrease in apnea/hypopnea index and oxygen desaturation index as well as daily sleepiness is observed in the majority of patients who underwent Barbed Stitch Reposition Pharyngoplasty. All patients suffer from postoperative sore throats of varying intensity. The pain may last up to 2 weeks postoperatively. The most common complications reported by patients include odynophagia—71%, swallowing disorders—51%, and short-term feeling of a foreign body in the throat—52% [1–3]. The postoperative surgical success rate ranged 65.4–93% of cases.

Conclusions: Barbed Stitch Reposition Pharyngoplasty is a relatively safe and effective method of surgical treatment for obstructive sleep apnea syndrome. The success of the procedure is enhanced by proper patient selection, surgical experience, and knowledge of functional upper airway anatomy.

KEYWORDS:

barbed stitch reposition pharyngoplasty, obstructive sleep apnea syndrome, sleep surgery

STRESZCZENIE:

Wstęp: Metody leczenia operacyjnego zespołu obturacyjnych bezdechów podczas snu odgrywają coraz większe znaczenie. Rozwój technik chirurgicznych pozwala na mniejszą inwazyjność zabiegu, lepsze efekty leczenia i większą możliwość przywracania prawidłowego funkcjonowania górnych dróg oddechowych. Jedną z metod operacyjnych leczenia tego zespołu są faryngoplastyki. Wśród nich faryngoplastyka repozycyjna z zastosowaniem szwów bezwężłowych jest coraz powszechniej stosowana.

Cel: Przedstawienie techniki operacyjnej faryngoplastyki repozycyjnej z zastosowaniem szwów bezwężłowych, wskazań i przeciwwskazań do tego zabiegu oraz ryzyka powikłań i wskaźnika powodzeń.

Materiał i metoda: Przeprowadzono przegląd literatury w bazie danych PubMed z lat 2012–2023, która dotyczyła techniki operacyjnej faryngoplastyki repozycyjnej z zastosowaniem szwów bezwężłowych z uwzględnieniem doświadczeń własnych.

Wyniki: U pacjentów po faryngoplastyce repozycyjnej z zastosowaniem szwów bezwężłowych obserwuje się istotne obniżenie wskaźnika bezdechów/spłyconego oddychania i wskaźnika desaturacji oraz senności dziennej po zabiegu. Chorzy najczęściej skarżą się na ból o różnym natężeniu w obrębie ustnej części gardła w okresie pooperacyjnym, który może się utrzymywać do 2 tygodni po zabiegu. Do najczęstszych powikłań należą: odynofagia—71%, zaburzenia połykania—51% oraz krótkotrwałe uczucie obecności ciała obcego w gardle—52% [1–3]. Niedomoga podniebieno-gardłowa może wystąpić do 5 dni po zabiegu. Wskaźnik powodzenia tej operacji waha się 65,4–93% przypadków.

Wnioski: Faryngoplastyka repozycyjna z zastosowaniem szwów bezwężłowych jest stosunkowo bezpieczną i skuteczną metodą chirurgicznego leczenia zespołu snu z bezdechami. Powodzenie zabiegu zwiększa prawidłowa kwalifikacja pacjentów, doświadczenie chirurgiczne i znajomość anatomii górnych dróg oddechowych.

Słowa kluczowe: faryngoplastyka repozycyjna z zastosowaniem szwów bezwęzłowych, leczenie chirurgiczne zespołu obturacyjnych bezdechów podczas snu, zespół obturacyjnych bezdechów podczas snu

ABBREVIATIONS

BMI – body mass index
BRP – Barbed Reposition Pharyngoplasty
ESP – expansion sphincter pharyngoplasty
OSA – obstructive sleep apnea
PAP – positive airway pressure
U3P – uvulopalatopharyngoplasty
VAS – Visual Analogue Scale

INTRODUCTION

Obstructive sleep apnea (OSA) is a disease characterized by recurring episodes of upper airways collapse and obstruction during sleep, associated with drops in arterial oxygen saturation. Modifiable OSA risk factors include: alcohol consumption, smoking, taking muscle relaxants (benzodiazepines, opioids), obesity, and hypothyroidism. Non-modifiable risk factors are age, African-American race, and being male. The most common manifestations of OSA that patients experience during the day include hypersomnia, habitual daytime naps, poor concentration, and fatigue. Night-time symptoms include loud snoring, fragmentation of sleep, nocturnal urination, and excessive night sweats [4, 5]. OSA treatment options can be classified into surgical and non-surgical interventions. First-line treatment for OSA, particularly in moderate and severe forms of the disease, is based on positive airway pressure (PAP) therapy. Unfortunately, according to literature reports, as many as 40% to 80% of patients demonstrate poor tolerance or even complete intolerance for this kind of treatment [6–9].

However, rapid development of surgical techniques observed in recent years has allowed clinicians to offer patients less invasive procedures characterized by better treatment outcomes and higher chances of restoring proper functioning of the upper airways. Pharyngoplasty represents one of the surgical methods used for treating OSA. Among all pharyngoplasty procedures, a Barbed Reposition Pharyngoplasty (BRP) performed with knotless sutures has recently noted a growing popularity [10, 11].

AIM

This publication aims to present the details of surgical technique in Barbed Reposition Pharyngoplasty using knotless sutures, as well as to discuss indications and contraindications, complication risk and success rate for this procedure.

MATERIALS AND METHODS

A review of literature from the PubMed database was conducted. We have analyzed papers published in the years 2012–2023 which

refer to the surgical technique in Barbed Reposition Pharyngoplasty. Moreover, we have included findings from our own clinical experience.

INDICATIONS

Indications for BRP include moderate and severe OSA, intolerance to PAP therapy or lack of patient's consent for such treatment, failure of other surgical treatments for sleep apnea, body mass index (BMI) <35, oblique or intermediate palatal phenotype, oropharyngeal obturation classified as antero-posterior or lateral, absence of structural abnormalities in the facial skeleton such as retrognathia, presence of systemic comorbidities or past diseases which increase the risk associated with general anesthesia and the postoperative period [11].

SURGICAL TECHNIQUE

Barbed Reposition Pharyngoplasty (BRP) using knotless sutures is a surgical procedure performed in the oropharynx. It is one of the surgical treatment methods for patients diagnosed with OSA who do not tolerate or do not consent to PAP therapy. The BRP technique was first described by a team of otorhinolaryngologists from Milan in 2012 [12]. This surgical procedure is aimed to reduce the upper airway collapse by stiffening the oropharyngeal walls, enlarging the oropharyngeal lumen in its anteroposterior and lateral dimensions and widening the retropalatal space.

Repositioning the velopharyngeal muscle forward, upward and sideways moves the muscle vector, creating a wider oropharyngeal space. The soft palate is stiffened and moved forward by placing a continuous knotless suture in the shape of a double "W". The most commonly used sizes of soluble knotless sutures are 2/0 or 3/0.

The BRP surgery is performed under general anesthesia with oral or nasal intubation. The first stage of the procedure involves bilateral tonsillar reduction sparing the mucosa of the palatoglossal arches (Fig. 1.).

Then, the posterior nasal spine and midpoint at the base of the uvula are located. Point No. 1 should be marked halfway between these two points. The next two points are located above the right and left palatoglossal arches, while another two points represent the two pterygoid hamulus regions of the pterygoid processes in the sphenoid bones. When all points have been identified, proceed with connecting all the dots. The last two lines run bilaterally along the pterygomandibular suture (Fig. 2.). The suture is placed starting at point No. 1 and runs to the point above the left palatoglossal arch (Fig. 3.) and to the point in the pterygoid hamulus region. The surgeon then wraps the suture twice around the fibers of the longitudinal part of the velopharyngeal muscle (Fig. 4.) and moves them upwards, to the front and sideways to the pterygoid hamulus region (Fig. 5.). This stage of the surgery is then followed by repeating the same actions on the right side.

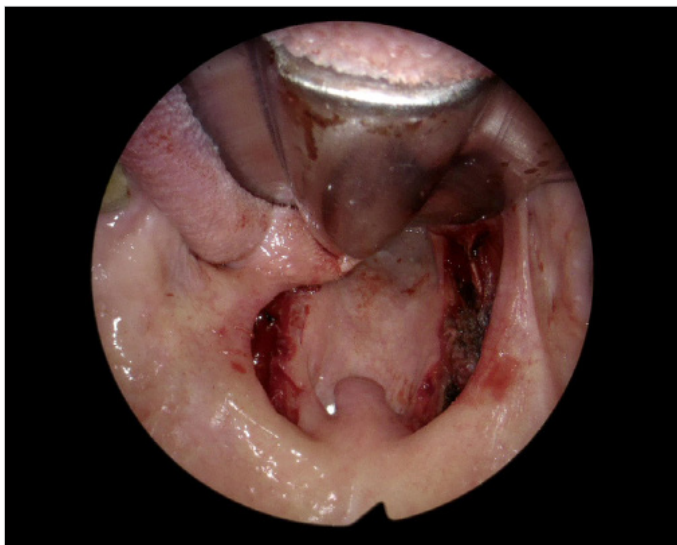


Fig. 1. Oropharynx. A view after bilateral tonsillectomy.

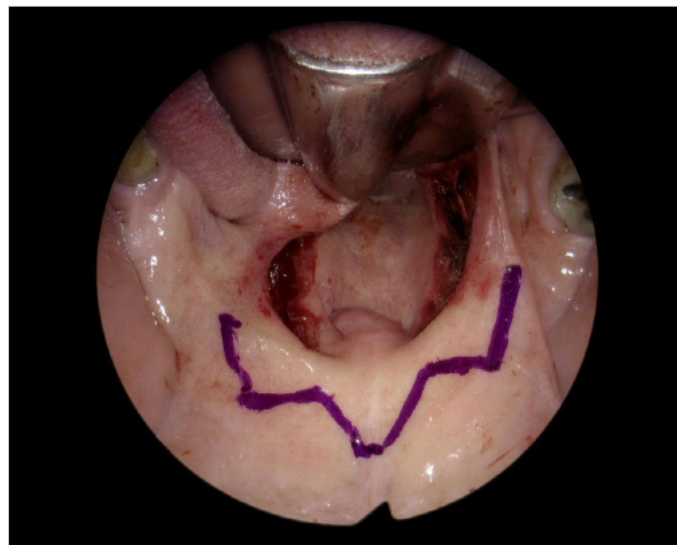


Fig. 2. The guiding line of knotless sutures is marked with a marker.

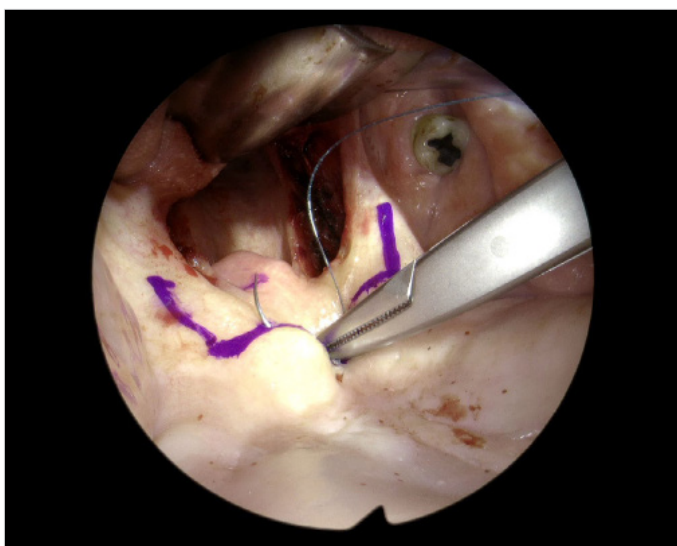


Fig. 3. Making a suture from point No. 1 (the center of the distance between the posterior nasal spine and the base of the uvula) to point No. 2 (over the left palatoglossal arch).

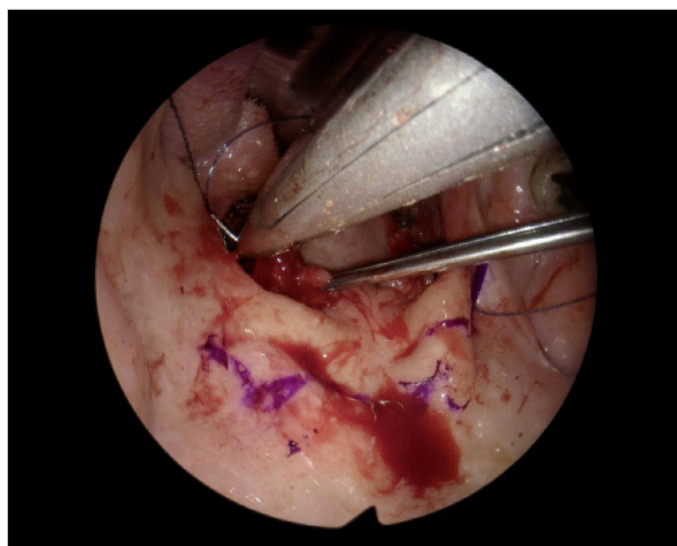


Fig. 4. Wrapping the surgical suture around the longitudinal part of the left palatopharyngeal muscle.

After completing this step, the surgeon may now return to operating on the left side and wrap the suture around the velopharyngeal muscle one more time. The next move involves anchoring this suture at the previously placed pterygomandibular suture. Suturing shall be completed in the middle part of the soft palate. The same procedure needs to be repeated on the right side.

Excessive mucosa of the uvula shall be carefully removed with the use of an electric knife, paying special attention to avoid cutting through the muscular part of the uvula and leaving a little more mucosa in the posterior part [1–3].

POSTOPERATIVE SYMPTOMS AND COMPLICATIONS

Based on the third author's (EO) own clinical experience, patients who undergo this type of surgery complain of pain up to 2 weeks after the

procedure. The severity of pain is measured with the Visual Analogue Scale (VAS). There is a strong recommendation that both the intensity of pain and a patient's response to painkillers should be monitored in the postoperative period. Such management allows clinicians to adopt an appropriate analgesic approach and modify treatment as needed. Often there are indications to administer opioid drugs.

Postoperative complications which are most frequently reported by the patients involve: odynophagia – 71%, dysphagia – 51% and a short-term foreign body sensation in the throat – 52% [2, 3, 13]. Velopharyngeal insufficiency may occur within the first three to five days after the procedure (author's own experience). Although Saenwandee et al. observed velopharyngeal insufficiency in 15% of cases, the researchers did not specify how many patients developed a chronic disorder [14].

Many authors also report episodes of suture extrusion [10, 14]. Knotless sutures are designed to remain in the tissues and be

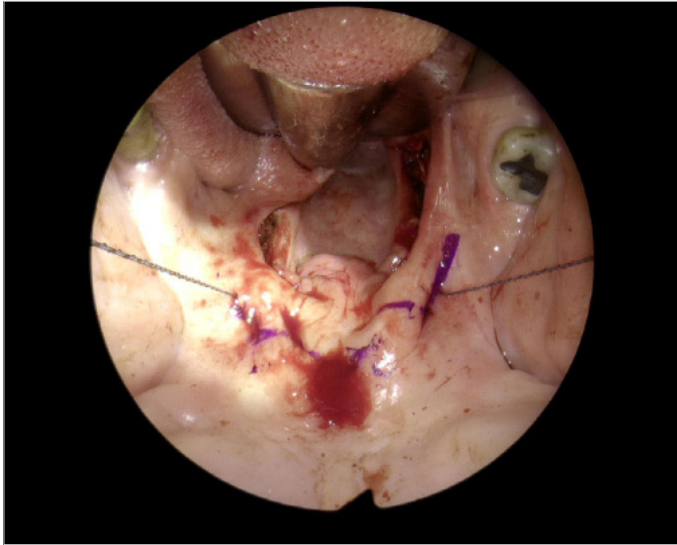


Fig. 5. Oropharynx. The stage of the procedure is just after the relocation of the palatopharyngeal muscle superiorly, anteriorly and laterally on both sides.

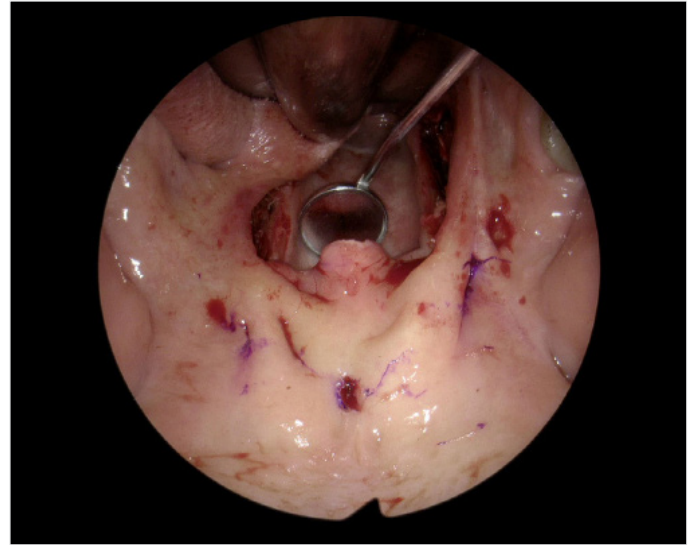


Fig. 6. A view of the oropharynx at the end of barbed stitch reposition pharyngoplasty.

invisible from the outside. However, it may sometimes occur that such suture protrudes outside the mucosa of the soft palate, leading to a stinging sensation or irritation of the surgical site, especially in situations when sutures are placed too superficially. Fortunately, this complication is not permanent, as the surgery is performed with the use of dissolvable sutures. The sutures should dissolve within six months after the procedure, resulting in a complete resolution of symptoms. Results presented by Gulottamet al. show that suture extrusion occurred within 7 days after the BRP surgery in approximately 30% of patients, while another 77% of patients experienced this complication in the period from day 7 to 2 months after the surgery [15].

Permanent complications after the BRP surgery are rarely observed and include: foreign body sensation in the throat – 7.8%, retention of mucus in the throat – 5.9%, dysphagia – 3.6%, rhinolalia – 3.1%, retention of mucus in the throat – 1.1%, regurgitation – 0.8%, feeling of a dry throat – 0.6%, as well as presence of tissue protrusions in the throat which imitate a tumor – 0.3% [10].

RESULTS

Considering our own experience and the reports from other clinical centers, we can state that BRP is an effective treatment method for OSA. Performing this surgery is associated with a decrease in the apnea/hypopnea index and lower desaturation index, as well as an increase in the arterial oxygen saturation which are observed in approximately 74% of patients who are operated on with this technique [16].

Long-term results presented by Cammaroto et al. demonstrate a reduction in the average AHI value from 31.5 to 11.4 after BRP surgery [17]. Neruntarat et al. conducted a meta-analysis comparing postoperative outcomes of BRP surgery with an expansion sphincter pharyngoplasty (ESP). The authors emphasized shorter operation time of BRP as compared to ESP. They also proved that, based

on four publications cited in their analysis, a reduction in AHI values was observed in 74.03% of patients from the BRP group, as compared to 60.17% of patients in the ESP group. Neither the differences in the average AHI reduction between both study groups, nor the differences in AHI values measured in both groups before and after surgery were found to be statistically significant [18]. A year later, the same authors conducted a meta-analysis of 20 publications. The results of their research indicate a significant reduction in the AHI index after BRP treatment – the average reduction was 69%. Moreover, they also reported a significant reduction in the ODI index and improvement of daytime hypersomnia symptoms [14].

Rashwan et al. compared BRP surgery with other types of pharyngoplasty procedures, such as the ESP and uvulopalatopharyngoplasty (U3P). The authors confirmed a significantly greater reduction in AHI values after BRP surgery as compared to other pharyngoplasty procedures analyzed in their study. BRP technique was also found to ensure a significantly greater decrease of the desaturation in comparison to ESP technique [19]. Iannella et al. conducted a systematic review of fifteen original prospective and retrospective articles included in their study criteria and presented the success rate of BRP. Successful procedure was considered one that resulted in a reduction of the initial AHI value by 50% and/or AHI values below 20 after the surgery. According to their reports, the BRP success rate ranged from 65.4 to 93% [11].

CONCLUSIONS

Barbed Reposition Pharyngoplasty with the use of knotless sutures is a relatively safe and effective method of surgical treatment for obstructive sleep. The success rate of BRP procedures may be enhanced by adequate selection of patients, as well as by surgical experience and knowledge of the functional upper airway anatomy presented by the operating team.

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