

Chondrolaryngoplasty in transgender women: Prospective analysis of voice and aesthetic satisfaction of 15 patients

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Abstract

Key points: Chondrolaryngoplasty or “tracheal shaving” is cosmetic surgery to reduce the laryngeal prominence in transgender women. Chondrolaryngoplasty represents a challenge in seeking a balance between aesthetics and function: a very conservative resection of the thyroid cartilage may lead to aesthetic dissatisfaction, while excessive resection may destabilize the anterior commissure tendon, causing permanent vocal damage. This was the first study to assess fundamental frequency and GRBAS scale before and after the surgery and there was no permanent vocal change in any of the patients. The midpoint of the height of the thyroid cartilage was a simple, easy to perform and safe parameter to locate and preserve the anterior commissure. Smoothing the edges and flattening the residual laryngeal prominence with a 4 mm diamond burr enabled major remodeling without a temerarious resection. All 15 patients presented a positive variation in the visual analogue score for aesthetic satisfaction, with a mean improvement of 8.6 ± 1.9 out of 10. Chondrolaryngoplasty led to significant aesthetic satisfaction in transgender women. The surgery caused no vocal change.

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Keywords: Transgender Persons.Sex Reassignment Procedures. Plastic Surgery. Thyroid Cartilage. Voice.

MAIN BODY

Introduction

Gender dysphoria is estimated to occur in over 1 million people in the United States.¹ The laryngeal prominence demarcated in the cervical region, commonly known as the “Adam’s apple”, is one of the stigmatizing secondary sexual characteristics of men and it is a notable obstacle to the full exercise of transgender women’s social and professional role.²

Chondrolaryngoplasty or “tracheal shaving” is cosmetic surgery to reduce the cervical projection of the laryngeal prominence, initially described by Wolfort and Parry² in 1975. In retrospective studies, around 85% of patients submitted to chondrolaryngoplasty report improvements in the appearance of the laryngeal prominence and satisfaction with the scar.³ Complications, although rare, may include damage to the vocal folds and epiglottic destabilization.⁴

To the best of our knowledge, to date, there has been no prospective study in the literature that analyzes the aesthetic and functional results of chondrolaryngoplasty. Thus, the objectives of this research were to assess safety, consequence on voice quality, and effectiveness (i.e., subjective aesthetic satisfaction) of chondrolaryngoplasty in transgender women.

Materials and methods

Ethical considerations

This study was conducted in accordance with the Helsinki Declaration and was approved by the ethics committee of [Removed for blind review]. Informed consent was obtained from each patient.

Study design and patients

This was a prospective interventional cohort, conducted at the Hospital das Clínicas da UFPE, Recife, Brazil. The recruitment period was from March 2018 to October 2019. The population consisted of consecutive transgender women diagnosed with gender identity disorder, according to the criteria of the World Professional Association for Transgender Health Inc.,⁵ monitored for at least 2 years in the hospital, with aesthetic dissatisfaction regarding the laryngeal prominence. The exclusion criteria established were: presenting with clinical or psychiatric comorbidity prohibiting surgical treatment or inappropriate physical characteristics for the procedure.

Pre- and Postoperative Assessment

Eligible patients were assessed by photographic records of the laryngeal prominence and laryngostroboscopy by a senior laryngologist (B.T.M.). For subjective analysis of the laryngeal prominence, we used a visual analogue scale (VAS) for aesthetic satisfaction, graded from 0 (very ugly) to 10 (very beautiful), applied at the preoperative consultation and in the sixth postoperative month, based on the Utrecht questionnaire validated for aesthetic rhinoplasty.⁶

To assess the effects of the surgical procedure on vocal quality, voice recordings were made in the immediate preoperative period and on the thirtieth postoperative day, using Voxmetria[®] (CTS Play). The voice of each patient was recorded in an individual sound file and anonymously labeled. These samples were randomized, and voice assessment was performed blindly by one experienced listener, who did not participate in the research. We analyzed the fundamental frequency (F0) and the auditory-perceptual voice assessment with the Hirano GRBAS scale.

Technique

All patients were submitted to chondrolaryngoplasty under general anesthesia and orotracheal intubation, by the same team of otolaryngologists (B.T.M., M.M.A.C.), using the same surgical technique. A median transverse anterior cervical incision of 3cm was made in a previous cervical cutaneous fold over the larynx and an upper and lower subplatysmal flap was created. After diuresis of the muscle planes, the thyroid cartilage was exposed. The external and internal perichondrium from the region of the laryngeal prominence to be resected were detached. The height of the thyroid cartilage was then measured and the midpoint of the distance between the thyroid notch and the lower margin of the thyroid cartilage (projection of the anterior

commissure of the vocal folds) was identified, an area that must be preserved to avoid disinsertion of the vocal folds. After delimiting a safe margin of 3 mm above the midpoint of the height of the thyroid cartilage, the laryngeal prominence and the upper portion of the cartilage were resected in a "V" shape, also including the upper border along the thyroid notch. For this resection, a scalpel blade number 15 and/or a 2 mm surgical cutting burr was used (if calcified cartilage, especially in patients aged over 40). After resection, a crucial step in this procedure was to smooth the edges and flatten the residual laryngeal prominence with a 4 mm diamond burr. Finally, the planes were then closed, followed by intradermal suture, without placing a drain (Figure 1).

Statistical Analysis

Statistical analysis was performed using SPSS®23.0 (IBM, Armonk, NY). Statistical significance was compared using a Wilcoxon signed rank test. Statistical significance was fixed at $\alpha = 0.05$.

Results

A total of 15 patients were included. The mean age was 31.7 ± 8.3 years (range 22 to 51 years). The mean time of multidisciplinary monitoring at the service before undergoing chondrolaryngoplasty was 3.6 years (range 2 to 9 years). The mean number of surgeries prior to chondrolaryngoplasty was 1.2.

Laryngostroboscopy examinations were normal in all patients.

The average postoperative follow-up time was 15.3 ± 6.1 months (range 6 to 25 months).

Aesthetic Satisfaction

Fifteen (100%) patients presented a positive variation in the VAS score when comparing the pre- and post-operative appearance of laryngeal prominence. Before surgery, 8 (53%) patients had graded the appearance of the laryngeal prominence as 0, while in the postoperative period, 10 (67%) patients graded it as 10 (Figure 2). The mean value of the preoperative VAS was 0.7 ± 1.0 and postoperative, 9.3 ± 1.1 , with a mean improvement of 8.6 ± 1.9 , with statistical significance ($P < 0.001$; 95% CI 7.3-9.6).

Voice Analysis

Voice analysis was performed with 11 patients, since 4 patients were excluded due to additional concurrent pitch-raising vocal surgery. In the assessed patients, the mean pre-operative fundamental frequency was 171.3 ± 41.2 Hz and in the post-operative, 177.1 ± 39.5 Hz, with a mean difference of 5.8 ± 10.5 Hz, with no statistical significance ($P = 0.74$; 95% CI = -30.1 to 41.7; Figure 3). There was no statistically significant difference in the GRBAS scale of the mean value of each of the five categories before and after surgery (Table 1).

Amongst the complications, one patient (7%) presented with a hyperpigmented scar and two (13%) reported hoarseness during the first postoperative week, which was overcome without the need for specific treatment. There were no major complications such as disinsertion of the epiglottis or vocal folds.

Discussion

Spiegel⁷, in a retrospective study, indicated that 60% of the 31 patients who underwent chondrolaryngoplasty were "very" or "completely" satisfied. In our sample, all patients demonstrated aesthetic satisfaction after surgery, whereby 80% of the VAS scores were between 9 and 10. We introduced the use of the diamond burr to flatten the remaining thyroid cartilage, thereby enabling major remodeling without a temerarious resection, perhaps one of the key points for surgical success.

It was demonstrated, prospectively and objectively, that there was no permanent vocal change in any of the patients during the postoperative period. Two patients reported hoarseness in the first week, possibly due to transient laryngeal edema from surgical manipulation or even by orotracheal intubation, which was resolved itself without the need for any specific treatment. The variation observed in the F0 and in the GRBAS had no statistical significance and is probably part of the daily changes within the normal range of each individual.⁸

Chondrolaryngoplasty represents a challenge for the surgeon in seeking a balance between aesthetics and function: a very conservative resection of the thyroid cartilage may lead to aesthetic dissatisfaction, while excessive resection may destabilize the anterior commissure tendon, thereby signifying permanent vocal damage, with hoarseness and decrease in vocal pitch, which would be tragic for a transgender woman.

Spiegel⁵, in 2008, described a surgical approach using a laryngeal mask airway combined with intra-operative fiberoptic laryngoscopy examination to mark the implantation height of the anterior commissure in the thyroid cartilage with a 22-gauge needle, and consequently at the safe limit of the resection of the thyroid cartilage. In our study, the midpoint of the height of the thyroid cartilage was used as a parameter for insertion of the anterior commissure, with an additional safety margin of 3 mm. This parameter had already been employed since Isshiki type I thyroplasty and was objectively measured by Sagiv⁹ in 2016. It proved to be simple, easy to perform and safe. Furthermore, unlike Spiegel's technique, it can be executed under general anesthesia with endotracheal tube, especially when performing another sex reassignment procedures simultaneously.

This study has several limitations. Initially, the number of participants was small, and might not have reliably represented the population. Secondly, due to the study design and ethical aspects, it was not possible to establish a control group to eliminate the influence of the placebo effect. Moreover, there was no objective measurement of the laryngeal prominence before and after surgery, demonstrating in fact that there was a significant reduction.

Conclusion

Chondrolaryngoplasty with resection of the laryngeal prominence was a safe and effective procedure for the aesthetic adequacy of transgender women, with significant patient satisfaction regarding the postoperative cervical appearance. The surgery caused no vocal change. There was no major complication of chondrolaryngoplasty in this study.

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Data Availability Statement The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

TABLES

	TABLE I Overall Pre- and Postoperative Voice Assessments	TABLE I Overall Pre- and Postoperative Voice Assessments	TABLE I Overall Pre- and Postoperative Voice Assessments	
	Preoperative Mean (SD)	Postoperative Mean (SD)	Difference (CI 95%)	P
Grade	0.91 (0.31)	0.72 (0.25)	- 0.19 (-0.07 to 0.43)	.50
Roughness	0.63 (0.21)	0.45 (0.15)	- 0.18 (-0.01 to -0.34)	.30
Breathiness	0.45 (0.15)	0.45 (0.15)	0 (-0.13 to 0.13)	.97

SD = Standard Deviation. CI = Confidence Interval.

FIGURE LEGENDS

Fig. 1: Surgical steps. A: surgical positioning with a cushion under the shoulders and a head ring to support the head. B: marking the area of the thyroid cartilage to be resected, 3 mm away from the midpoint of the cartilage height. C: cartilage appearance after resectioning the prominence. D: smoothing and flattening of the edges of the remaining thyroid cartilage. E: resected portion of the thyroid cartilage, in a “V” shape. F: immediate postoperative aspect of the surgical wound, in profile.

Fig. 2: VAS = Visual AnalogueScale. Distribution of VAS grades for aesthetic satisfaction, before (mean = 0.7 ± 1.0) and after surgery (mean = 9.3 ± 1.1). Mean variation = 8.6 ± 1.9 ($P < 0.001$; CI 95% 7.3-9.6).

Fig. 3: F0 = fundamental frequency. Hz = Hertz. Mean F0(Hz) - Preoperative = 171.3 ± 41.2 Hz, and Postoperative = 177.1 ± 39.5 Hz. Each line represents 1 patient. Mean variation = $5.8 \text{ Hz} \pm 10.5 \text{ Hz}$ ($P = 0.74$; CI 95% = -30.1 to 41.7).

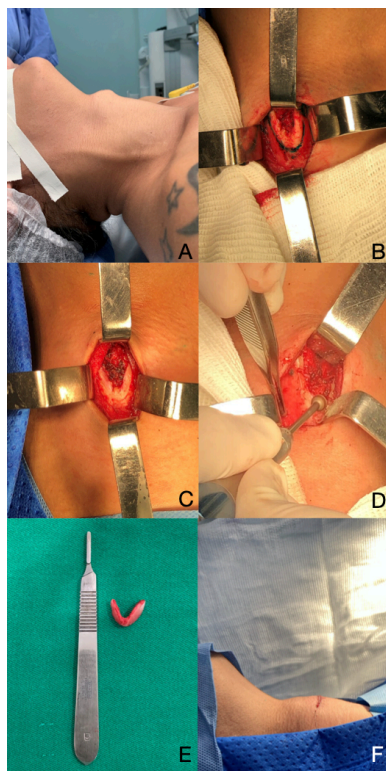


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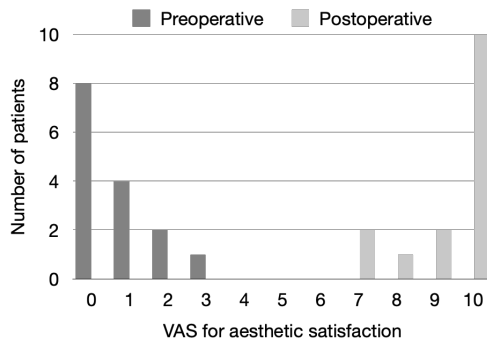


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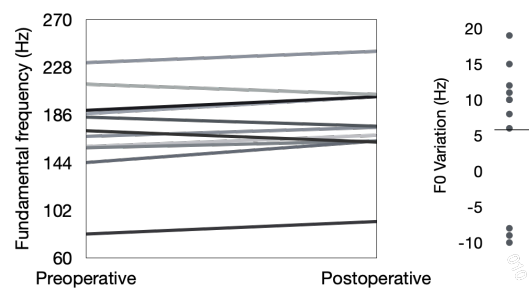


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