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SPONTANEOUS VOCAL FOLD POLYPS REMISSION AFTER LOCKDOWN FOR COVID-19 PANDEMIC: DOES VOCAL LOAD MATTER?

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Abstract

Objective. During the Italian lockdown for Covid-19 emergency, due to stay-at-home orders, many people experienced an unusual period of voice rest. The present case series aims at reporting the spontaneous regression of some vocal fold polyps during the Italian lockdown for SARS-CoV2 pandemic.

Methods. 5 patients with voice complaints presenting to a tertiary referral center and diagnosed with vocal fold polyps before the lockdown were included. Because of the lockdown restrictive measures, planned elective surgical procedures were suspended. The patients were re-assessed immediately after lockdown. Multidimensional voice assessments were conducted before and after the lockdown period through laryngostroboscopies, perceptual voice evaluations, electroacoustic analysis and self assessments.

Results. The patients included in the present case series experienced a complete or nearly complete remission of symptoms. Videolaryngostroboscopies documented a complete or nearly complete regression of the polyps. Voices considerably improved both perceptually and electroacoustically. Self assessments showed a reduction of voice-related complaints.

Conclusions. The present study suggests that daily vocal load reduction may play a critical role in the conservative management of vocal fold polyps.

Key words: SARS-CoV2; Covid-19; lockdown; vocal fold polyps; remission; vocal load

1 Introduction

Coronavirus Disease 19 (COVID-19), caused by Coronavirus SARS-CoV2, outbreaked in Wuhan (China) in December 2019[1]. COVID-19 was classified by World Health Organization as pandemic, representing a global public health emergency. In the first phases of the pandemic Italy was one of the most hard hit countries. Limited capacity of hospitals and intensive care units heavily burdened the Italian health system. As a result, lockdown measures were adopted and on 9th March 2020 the whole country was declared red-zone. The number of hospitalizations started decreasing after 14 days of lockdown, highlightening the efficacy of the adopted strategy[2]. The major restrictive measures of the so called Phase I (the lockdown) lasted from the 9th of March till the 3rd of May; from the 4th of May to the 14th of June the Phase II took place, with a gradual reduction of the restrictive measures. From the 15th of June on, a further reduction of the restrictive measures has opened the doors to a gradual return to a normal life for the population[3].

During the lockdown, the Italian healthcare system was forced to an unprecedented pressure which threatened its sustainability. As a consequence, all the elective and non oncologic planned surgical procedures were suspended, in order not to overload the healthcare personnel.

The majority of people experienced work stops or remote working solutions during phase I and II, with reduced social interactions. Such condition determined a dramatic reduction of the daily vocal load in several cases. As a consequence, professional voice users experienced an unusual period of forced voice rest, which might be a protective factor for some phonotraumatic vocal lesions[4].

Some of the most frequent vocal pathologies caused by hyperfunctional voice use are vocal folds polyps (VFPs). They represent common laryngeal benign lesions with a phonotraumatic etiology and can determine significant voice impairment. Concerning VFPs treatment, albeit phonosurgical exeresis by direct microlaryngoscopy (DML) is classically considered the preferred option by many

authors[5], in the last years other conservative therapeutic options have been described[6]. Surgical conservative approaches include office-based fiber-endoscopic phonosurgery (FEPS) under local anesthesia with the use of microscissors and microforceps[7,8], the use of endoscopic lasers such as the Potassium Titanyl Phosphate (KTP)[9-11] and transnasal endoscopic steroids injections (TESI) procedures[12, 13]. Non surgical conservative therapeutic options described for VFPs include medical treatments, voice therapy and vocal hygiene programs as suggested by several authors[14-19].

In the present study, a case series of 5 patients affected by VFPs is presented. The patients were diagnosed with VFPs before the lockdown and scheduled for surgery, but the elective surgical procedure was suspended because of the epidemiological emergency. After the lockdown, the patients were all reassessed.

2 Materials and Methods

The present case series study was carried out according to the Declaration of Helsinki. All subjects enrolled in the study gave their informed consent; experimental data were collected prospectively.

2.1 Population

Five female patients presenting to a tertiary referral center complaining vocal symptoms of moderate severity were diagnosed with vocal folds polyps between February 4th and March 9th 2020. They were all scheduled for phonosurgical exeresis. The patients were 33, 36, 39, 52 and 53 years old. None of the patients was a smoker, no other medical issues were declared in their medical histories. All the patients reported a professional voice use, as two of them worked as corporate employees, one of them as business manager, one as educator and one as medical doctor. Mean duration of vocal symptoms was 58 $\pm$ 24 days. The reported symptoms were hoarseness, vocal fatigue, breathy voice quality and lack of vocal power.

The patients of the present study received diagnosis right before the beginning of the lockdown but the scheduled elective surgical procedure was suspended because of the restrictive measures due to the pandemic of Covid-19. None of the patients neither received pharmacological therapy nor underwent speech therapy after diagnosis. During the lockdown, all the patients experienced a significant decrease of daily vocal load since they all had a dramatic reduction of working and social activities. The patients reported a mean daily professional vocal load of 6 hours. During lockdown, vocal load reduction was self-reported by the patients and quantified as a decrease of at least 70% of the daily use of voice. After lockdown phase I, the patients were re-assessed. Mean time between diagnosis and re-assessment was 101 $\pm$ 16 days.

The patients included in the present study were diagnosed with 2 gelatinous sessile polyps; 1 hemorrhagic sessile polyp; 1 hemorrhagic sessile polyp with contralateral nodular lesion and 1 pedunculated gelatinous polyp with contralateral hemorrhagic lesion, as shown in figure 1.

2.2 Procedures

Each patient underwent a multidimensional voice assessment before and after lockdown.

The patients were asked to perform a sustained vowel /a/ at comfortable pitch and intensity and to read a 34-words and 55-syllables phonetically balanced passage. Voices were recorded with a microphone Samson Meteor Mic (Samson Technologies, Hauppauge, NY) connected via USB to a MacBook Pro computer (Apple, Cupertino, CA) running PRAAT software (version 6.0.43 for Mac, Boersma & Weenick, University of Amsterdam, Amsterdam, The Netherlands). Audio signals were digitized on 16 bit at a sampling frequency of 44 kHz. Voice recording was performed in standard conditions, with a mouth-to-microphone distance of 30 cm, quiet environment (<40 dB), and constant gain.

Videolaryngostroboscopic examinations, perceptual voice evaluations, acoustic voice analysis and self assessment questionnaires were performed. Videolaryngostroboscopies were carried out with

a 70° Karl Storz telelaryngoscope and a Karl Storz Pulsar stroboscopic light source (KARL STORZ SE & Co. KG, Tuttlingen, Germany). Perceptual evaluations were carried out with the GRBAS scale basing on the recorded reading passage. The GRBAS scale is a widely used perceptual evaluation tool specifically addressing the following parameters of voice quality: grade (G), roughness (R), breathiness (B), asthenicity (A) and strain (S). Each parameter scores from 0 (normal voice) to 3 (severe dysphonia)[20]. Auditory-perceptual judgements were performed by a blinded expert and trained listener.

Acoustic analysis was carried out with PRAAT software (version 6.0.43 for Mac, Boersma & Weenick, University of Amsterdam, Amsterdam, The Netherlands), computing smoothed cepstral peak prominence (CPPS) [21] [22]; mean fundamental frequency (mF0) and the modified Titze's spectrographic classification (TSC)[23]. CPPS was calculated on the reading passage; modified Titze's spectrographic classification was performed basing on the spectrograms of the sustained /a/, displayed with a frequency range of 0-5000Hz and calculated with a 0.05 seconds window length and a 45 dB dynamic range. According to the classification, the following categories were used: (1) type 1 voices, periodic without strong modulations or subharmonics; (2) type 2 voices, with strong modulations, bifurcations, or subharmonics; (3) type 3 voices, smearing of energy across harmonics with visible fundamental frequency and few harmonics; and (4) type 4 voices, aperiodic.

Each patient completed the Italian version of the Voice Handicap Index (VHI)[24,25] with its three subscales: emotional, physical, and functional. The total score (possible range, 0–120 points) and subscales' scores (possible range, 0–40) were calculated; the higher the score, the greater the perceived voice handicap.

3 Results

Videolaryngostrobocopic features of the VFPs at diagnosis and after lockdown are shown in figure 1. After lockdown, videolaryngostroboscopies revealed a complete remission of the 2 gelatinous VFPs (A, B) and the hemorrhagic sessile polyp with contralateral nodular lesion (E); a nearly complete remission was observed for the peduncolated gelatinous polyp (C) and the other haemorrhagic sessile polyp (D).

At diagnosis, mean VHI scores were F = 19.2 ± 14.3; P = 26 ± 4.3; E = 13 ± 15.7 and Total = 58.2 ± 32.7. After lockdown, mean VHI scores were F = 5.2 ± 4.5; P = 13.8 ± 6.4; E = 1.2 ± 1.8 and Total = 20.2 ± 9.1, revealing a reduction for all the subscales. Mean GRBAS scores at diagnosis were G = 1.6 ± 0.5; R = 1.6 ± 0.5; B = 2 ± 0.0; A = 0.6 ± 0.5; S = 0.8 ± 1.1, while after lockdown were G = 0.4 ± 0.5; R = 0.2 ± 0.4; B = 0.6 ± 0.5; A = 0.0 ± 0.0; S = 0.0 ± 0.0. Perceptual evaluations showed a reduction for all the GRBAS parameters after the lockdown, revealing a better perceptual voice quality. At diagnosis, mean modified TSC was 2.4 ± 0.5 and acoustic analysis revealed a mean CPPs = 11.11 ± 1.02dB and mean mF0 198 ± 26 Hz. After lockdown, an improvement in all the tested acoustic parameters was observed, with a mean modified TSC of 1.2 ± 0.4 and acoustic analysis revealing a mean CPPs = 13.08 ± 0.6 dB and a mean mF0 213 ± 27 Hz.

Detailed results of the self assessments, perceptual and acoustic analysis are shown in table 1 and table 2. Spectrographic modifications before and after lockdown are shown in figure 1.

4 Discussion

In the present study, a series of spontaneously healed VFPs was presented. None of the patients underwent speech therapy, pharmacological or surgical treatments. After lockdown for Covid-19 epidemiological emergency, a complete or nearly complete remission was observed, with a considerable improvement of the voices both acoustically and perceptually, as well as for the voice-related handicap perceived by the patients.

The elective therapeutic choice for VFPs is phonosurgical exeresis performed by DML, allowing for a fast recovery and a good voice quality restoration. Nevertheless, some authors highlighted that VFPs can sometimes resolve without surgery thanks to conservative treatments. Some studies suggest that voice rest, programs of voice hygiene and voice therapy can be effective in treating some vocal folds polyps[18,19].

Considering non surgical conservative approaches for VFPs, some authors reported the efficacy of voice therapy in favoring the shrinking of the polypoid lesion and a concurrent improvement of voice quality. A study by Nakawa et al. outlined that of 132 patients with VFPs receiving voice therapy or medication, 55 (41.7%) showed complete remission and 29 (21.9%) showed shrinkage with a mean follow-up of 5.1 and 4.1 months, respectively. According to the authors, at least 9.7% of all VFPs can reach complete remission with voice therapy, thus avoiding surgery. The authors found that female sex, small size of the lesion and a shorter duration of symptoms are variables more likely associated with favorable outcomes after voice therapy[14]. Wang et al. recently compared vocal training and microsurgery in 69 patients with early VFPs[26]. Although the cure rate was higher for microsurgery (100% Vs 31.6%), the emotional subscale score of the VHI, maximum phonation time, Jitt% and dysphonia severity index were better in the vocal training group, suggesting that voice therapy has an important role in improving patients ability to control the vocal instrument, reaching a better voice-related quality of life. Klein et al. retrospectively analyzed a series of 34 patients with haemorrhagic VFPs and reported a resolution in 26.5% of patients who declined surgery and underwent voice therapy, with a mean resolution time of 4.4 months[17]. Zhuge and colleagues[27] reported a cure rate of 30.3% for voice therapy in early VFPs, confirming the results reported by Wang et al [25]. In a retrospective cohort study by Lee and colleagues[28], of 92 patients diagnosed with VFPs and receiving voice therapy, 40 patients improved and did not require surgical exeresis after an average period of 2 months. Multivariate analysis revealed that female sex and small polyp size were significantly related to successful voice therapy response, confirming the results of Nakawa and colleagues[14]. Nonetheless, a recent literature review by Ogawa and Inohara outlined that solid evidence supporting the efficacy of voice therapy and vocal

hygiene programs for the treatment of benign vocal fold lesions is still insufficient today because of methodological problems affecting the available studies[29].

To our knowledge, few data exist about the possible spontaneous regression of VFPs without any treatment. In a prospective study, Jeong and colleagues observed with a close follow-up the clinical course of patients with a diagnosis of VFP not willing to undergo phonosurgery. Of 94 VFPs, 43 (46%) showed a significant shrinking and 36 (38%) resolved without requiring surgery. Considering the 36 patients with a complete remission, nearly half of the polyps had resolved within 3 months and more than 80% of polyps had disappeared within 8 months. The multivariate analysis showed significant associations between the outcome of spontaneous regression and female sex, small sized lesions and short duration of symptoms[19].

In a recent randomized controlled trial by Hosoya et al. 200 patients with VFPs and vocal nodules were enrolled. A control group and an experimental intervention group (vocal education and vocal hygiene program) were compared. After 2 months of follow-up, a significantly higher resolution rate was observed in the intervention group (61.3% Vs 26.3%), suggesting that – even if a certain rate of spontaneous resolution can be observed, voice therapy programs have a role in affecting the outcome in a positive way[18].

The patients of the present study did not receive any pharmacological treatment or voice therapy, since they were all already scheduled for surgery. The common features of the patients were that they were all females, non smokers and with small-sized VFPs. They all experienced a 2 months long period of forced vocal load reduction because of the lockdown. All the patients revealed considerable improvements at videolaryngostroboscopy (3 complete remissions and 2 nearly complete remissions), perceptual and electroacoustic voice quality improvements as well as better VHI scores. Concerning self assessments, the only exception was a patient affected by gelatinous VFP, who had unvaried VHI scores. This is not surprising though, as the polyp didn't affect severely the voice of the patient because of its features and size. Overall, all the patients came back to a satisfactory voice after lockdown: complete remission was observed for the 2 gelatinous

sessile polyps and for the haemorrhagic polyp with contralateral nodular lesion, while nearly complete remission was observed for the haemorrhagic sessile polyp and the gelatinous pedunculated polyp with contralateral nodular lesion. The patients with nearly complete remission were the ones with the most severe lesions: the haemorrhagic sessile polyp was associated with a recent subepithelial diffuse right vocal fold haemorrhage, while the pedunculated gelatinous polyp was associated with an haemorrhagic contralateral lesion (figure 1).

The results of the present case series confirm the findings of Nakawa[14], Jeong[19] and Lee[28], as all the patients involved in the study were females, with small sized VFPs and a short duration of symptoms. These aspects should be taken into account in clinical practice, in order to consider conservative approaches for VFPs that are more likely to regress spontaneously or with conservative approaches.

The main limitations of the present study are the small number of recruited patients and the lack of a comparison group (e.g. patients who underwent surgery or a voice therapy program in the same period). Even if it's difficult to imagine a conservative treatment for VFPs exclusively based on a drastic and long-lasting vocal load reduction in our society, the present findings suggest that voice rest may have a critical role in favoring VFPs spontaneous remission. These aspects are worthy of future research, in order to define the best indications and the best strategy for a conservative management of VFPs.

5 Conclusions

The present study outlines the importance of daily vocal load on the clinical course of selected vocal fold polyps. Given that forced voice rest during the Covid-19 emergency was an extreme condition, the unusually high occurrence of VFPs spontaneous remissions immediately after lockdown suggests that reduction of daily vocal load may play a substantial role in the conservative management of vocal fold polyps.

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Tables

Table 1. Perceptual analysis and self-assessments before and after lockdown

	Before Lockdown									After Lockdown								
	GRBAS					VHI				GRBAS					VHI			
Pt. N.	**G**	**R**	**B**	**A**	**S**	**T**	**F**	**P**	**E**	**G**	**R**	**B**	**A**	**S**	**T**	**F**	**P**	**E**
1	1	1	2	1	0	45	18	21	6	0	0	1	0	0	13	4	9	0
2	1	1	2	1	0	23	0	23	0	0	0	0	0	0	23	0	23	0
3	2	2	2	0	2	69	22	31	16	1	0	1	0	0	33	12	17	4
4	2	2	2	1	0	109	40	30	39	1	1	1	0	0	22	7	13	2
5	2	2	2	0	2	45	16	25	4	0	0	0	0	0	10	3	7	0

Table 2. Acoustic analysis of voice signals before and after lockdown

	Before Lockdown		After Lockdown	
Pt. N.	**CPPS**	**mF0**	**CPPS**	**mF0**
1	11.61	178.2	14.11	183.2
2	11.61	210.6	12.90	194.9
3	11.96	170.0	12.45	206.2
4	10.97	199.2	12.95	249.0
5	9.39	235.9	13.02	235.7

Figures

Figure 1.

Endoscopic (right column) and spectrographic (left column) findings before and after lockdown. A: right gelatinous sessile polyp showing complete remission. B: left gelatinous sessile polyp showing

complete remission. C: right pedunculated gelatinous polyp with contralateral haemorrhagic lesion showing nearly complete remission. D: right haemorrhagic sessile vocal fold polyp showing nearly complete remission. E: right haemorrhagic sessile vocal fold polyp with contralateral nodular lesion showing complete remission. Spectrograms represent 3 seconds of sustained /a/ vowels, displayed with a frequency range of 0-5000Hz and calculated with a 0.05 seconds window length and a 45 dB dynamic range.