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Original Research Article

Role of Voice Quality Assessment Tools in Patients after Botulinum Injection for Spasmodic Dysphonia

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Abstract

Introduction: Spasmodic dysphonia (SD) is a neurological status of larynx with periodic dystonia of its muscles affecting the voice and speech. Botulinum toxin (BT) injected in the muscles of Larynx, helps in overcoming the dystonia. The final results of BT injection on the voice quality were measurable with various indices. This study was conducted to analyze the voice quality at fixed time intervals.

Aim: To evaluate quality of voice and speech in spasmodic dysphonia patients following BT injections at fixed time intervals. The objectives were to use VAS, VHI and GRBAS score as diagnostic tools for assessing the severity of SD before and after BT injections.

Materials: 38 subjects with SD were treated in the ENT Department of Kannur Medical College and Hospital, Anjarakandy, Kannur, Kerala were included. The patients were assessed for their degree of voice symptoms with visual analogue scale (VAS), GRBAS score and VHI (Voice Handicap Index) before and after BT injection.

Results: The VHI, VAS and GRBAS scores among the patients of both the BT group (Group A) and non-BT group (Group B) were almost similar before the commencement of treatment. One-Way ANOVA calculator including Turkey HSD analysis of the voice quality test scores showed significant improvement. The results of BT injection were statistically significant with p value 0.0001; p taken as significant at <0.05.

Conclusions: Perceptual evaluation of voice quality in patients with SD done at admission and at follow up after Botulinum Injections was good and voice quality assessment tools like VAS, VHI and GBRAS showed high sensitivity and specificity. The final outcome of quality of voice was statistically significant when compared to placebo treatment.

Keywords: Voice, Adductor spasmodic Dysphonia, Dystonia, speech, therapy and botulinum

Introduction

Spasmodic Dysphonia (SD) is a dystonic disorder of laryngeal muscles results in clinically, periodical, irregular and uncontrolled voice and speech [1,2]. SD is a

muscle neuron junction disorder causing the laryngeal muscles to set in task-specific contractions altering the speech [3]. Among the three types of SD, the most common variety was Adductor type (> 65%), followed by abductor type (30%) and rarely the mixed type [4]. Clinically the patient presents with sudden, periodical, irregular, uncontrollable, tight and strained voice which is very easy to recognize once heard [5]. But to assess the severity of the SD various special methods were evolved. They include a thorough clinical history taking, laryngeal endoscopy, stroboscopy, speech-pathological evaluation and neuro-phonological examination [6].

To express the voice disability of the patients in medical quantitative terms certain objective measures like acoustic parameters and speech perturbations were used [7]. They were classified as perceptual, acoustic and/or aerodynamic measurements [8,9]. The different words used to express the voice quality in patients with SD were feeble, jerky, sudden stops, intermittent, husky, squeaky, and aphonic [10,11]. Few study reports correlated the perceptual assessments using the above terms and acoustic measures in SD [12,13]. Pioneering works by Erickson [14] and Cannito *et al*. [15] showed the voice symptoms in SD were more demonstrable in sentences with voiced consonants than in voiceless consonant. The degree of voice symptoms were usually measured using a visual analogue scale (VAS) [16].

It consists of a 100 mm VAS scale. Scoring higher values in VAS scales indicated poor voice quality and lower scores indicated better voice quality. Point 0 is on the left and point 100 on the right side. (0): no dysphonia (100): the worst dysphonia. To inspect the abductor voice breaks three sentences were constructed containing serial voiced syllables [17]. For acoustic analysis nine words selected from were used acoustic analysis material was used [18]. Any abnormal speech was expressed as percentage of shifts in frequency, aperiodic segments and phonation breaks [19]. The GRBAS scale was also used to objectively evaluate the characteristics of dysphonia. Japan Society of Logopedics and Phoniatrics developed this scale [20] which measures objectively the abnormal features of SD. The scale grades the quality of voice as: Grade (G): indicates the severity of hoarseness, 2. (R) indicates roughness; rasping or rattling voice, 3. (B) For Breathiness; whispery voice 4. A: Asthenia; for a weak voice and 5. S: for Strain; effortful or constricted voice.

Each of these elements are scored as: 0 (normal), 1 (mild), 2 (moderate), or 3 (severe). Voice disorder in SD was characterized by a high score of the (S) element. Voice Handicap Index (VHI) was also used by many researchers to scale a patient assessed voice quality. Developed by Jacobson *et al* [21]**,** the scale grades the degree of voice disability produced by verbal communication impairment. It includes 30 items with a 5-point scale: 0- (never), 1- (almost never), 2- (sometimes), 3- (almost always), and 4 (always). Total score was from 0 to 120.

If the VHI score was higher, the severity of dysphonia was high and the subjective voice disorder was said to be more severe. The present study was aimed at evaluating the quality of voice and speech in SD patients following BT injections at fixed time intervals. The objectives were to use a reliable diagnostic tool for assessing the severity of SD and determine proper terms to characterize voice symptoms and to relate them to objective measures such as acoustic parameters or speech perturbation.

Materials

38 patients with Spasmodic Dysphonia were identified out of the total 632145 outpatients

of the Kannur Medical College and Hospital, Anjarakandy were included. These patients attended the department of ENT during the period between March 2021 and February 2022 for treatment. The ethics clearance certificate was procured from the Institute ethics committee. It also approved consent form and proforma to be used for the study.

Inclusion Criteria: Patients aged above 18 years and below 67 years were included. Patients of both genders were included. Patients with symptoms of SD were included. Patients with GRBAS moderate and severe scores were included. Patients with VAS scores above 65% were included. Patients with VHI greater than 70% were included. Patients who have undergone voice therapy within 8 weeks were included. Patients with neurological disorders with Parkinson's disease were included.

Exclusion Criteria: Patients aged below 18 years and above 67 years were excluded. Patients who have undergone laryngeal surgery were excluded. Patients who have previously undergone BT injections were excluded. Patients with acute or chronic laryngitis were excluded. Patients with laryngeal trauma were excluded. The 38 patients were divided into two groups. In Group A 19 patients were injected with BT in the laryngeal muscles. In group B patients were injected with distilled water as a placebo. All the patients were asked about their clinical symptoms, and predisposing factors.

Demographic data was elicited. All the patients were subjected to laryngeal endoscopy and when required stroboscopy was done. The degree of voice symptoms were measured using a 1 Visual analogue scale (VAS). All the subjects were assessed subjectively about their dysphonia using a 100 mm VAS scale. Higher the scores more the voice was affected. 2. The GRBAS scale was used to evaluate objectively the characteristics of dysphonia. This scale was graded as Grade (G): indicates the severity of hoarseness, 2. (R) indicates roughness; rasping or rattling voice, 3. (B) For Breathiness; whispery voice 4. A: Asthenia; for a weak voice and 5. S: for Strain; effortful or constricted voice. Each of these elements are scored as: 0 (normal), 1 (mild), 2 (moderate), or 3 (severe). Voice disorder in SD was characterized by a high score of the (S) element. 3. Voice Handicap Index (VHI) was used.

Statistical Analysis

The observed data was analyzed using mean, standard deviation and percentages. The Statistical Package for the Social Sciences version 14 was used. For the quantitative variables t-tests were used. For qualitative variables Chi-square tests were used. All tests were two-sided, and a P-value < 0.05 was considered statistically significant.

Results

Totally 38 patients with Spasmodic Dysphonia were identified among the 32145 outpatients who attended the department of ENT of Kannur Medical College, Anjarakandy during the period between March 2021 and February 2022. The prevalence of SD during that period was 0.11%. Out of 38 patients with SD included in this study there were 23 (60.52%) males and 15 (39.47%) females with a male to female ratio of 1.53:1. The mean age was 37.56±11.55 years. Patients aged between 28 and 47 constituted 20/38 (52.63%) of the total patients.

Among them11/38 (28.94%) belonged to group A and 09/38 (23.68%) belonged to group B. Among the 38 patients 18/38 (47.36%) patients were professional voice users and 20/38 (52.63%) patients were not professional users. (Table 1) There were 08/38 (21.05%) smokers and 30/38 (78.94%) non-smokers in the study. (Table

1) 06/38 (15.78%) patients were having thyroid deficiency and 32/38 (84.21%) patients were normal. The demographic factors like age, voice usage, smoking habit, thyroid deficiency and female-to-male ratios were not different in the two groups; p values were >0.05; p taken as significant at <0/05.

Table 1: Showed the age, gender and demographic details of the subjects (n-38; Group A-19, Group-B-19).

Variable	Group A- 19		Group B- 19		P value
	Male-12	Female- 07	Male-11	Female-08	
Age					
18 to 27- 07	03	01	02	01	
28 to 37- 10	04	02	03	01	0.166
38 to 47- 10	03	02	03	02	
48 to 57- 07	01	01	02	03	
58 to 67- 04	01	01	01	01	
Professionals voice					
Yes-18	05	04	06	03	0.246
No- 20	07	03	05	05	
Smoking					
Yes-08	04	01	02	01	0.181
No-31	08	06	09	07	
Thyroid deficiency					
Yes- 06	02	01	02	01	0.331
No- 32	10	06	09	07	

The VHI, VAS score and GRBAS scores among the patients of both the groups were almost similar (P values were >0.05; p taken as significant at <0/05). (Table 2)

Table 2: Showed the baseline values of the voice quality tools used (n-38; Group a-19, Group B- 19)

Diagnostic tool	Group A- 19	Group B- 19	P value
VAS	73.45±6.10	72.50±7.10	0.192
GRBAS	2.4±0.45	1.8±0.36	0.846
VHI	79.95±6.35	77.85±7.20	0.623

At fixed time intervals the voice quality was assessed and the scores were tabulated in Table 3. One-Way ANOVA calculator was used including Turkey HSD and found that the results were statistically significant with p value 0.0001; p taken as significant at <0.05.

Table 3

Voice quality evaluation tools	Initial mean values	2 weeks	4 weeks	8 weeks	12 weeks	P value
GRBAS						
SCORE	2.4±0.45	2.1±0.38	1.94±	1.6±0.35	1.1±0.20	0.00001
Group A	1.8±0.36	1.6±0.29	1.4±0.24	1.2±0.20	0.8±0.17	

Group B						
VHI Group A Group B	 79.65±6.10 74.10±585	 72.84±3.75 73.20±1.05	 65.40±3.45 70.65±2.80	 63.85±3.75 70.85±4.15	 68.45±3.95 69.55±1.20	0.00001
VAS Group A Group B	 73.45±5.24 72.55±5.44	 68.45±5.55 71.02±6.10	 64.90±3.25 70.55±3.65	 60.30±4.85 68.05±2.50	 63.25±4.50 67.15±3	0.00001

Patients who received BT injections had dramatic relief from SD in the study and the patients who received placebo did not show improvement in the voice quality.

Discussion

In the present study 38 patients who presented with clinical symptoms of SD were included. They were divided into two groups**.** In group A 19 patients were administered BT injection in to the laryngeal muscles as per the protocol. In group B the patients were given a placebo injection. Before the procedure the voice quality was assessed using the three qualities check tools i.e., Grabs score, VHI and VAS score.

Following the procedure at the intervals of 2, 4, 8 and 12 weeks the quality of the voice was assessed and found that there was high reliability were observed for both within the test group and between the test group and placebo groups (Table 3). In the present study, a speech pathologist and Phono-surgeon with good clinical experience in SD undertook the injections and assessed the voice quality.

Faham M, Ahmadi A *et al.* from their study recorded that the perceptual evaluation obtained from VAS scale showed a high sensitivity and specificity and hence suggested that VAS scale could be used as a valid tool for the voice quality evaluation in patients with SD [22]. Perceptual evaluation using VAS tool could be done without special equipment and it was a real time evaluation [23]. Review of literature showed that the patients with SD usually showed great individual differences in the four presenting voice symptoms [24]. In the present study however only overall voice quality was used to assess the baseline scores and post injections scores. Voice assessment by few authors was done, using Acoustic measures and Acoustic analysis requiring high tech instruments [24,25].

These measuring tools showed low sensitivity and high specificity, and hence missed true SD patients than perceptual evaluation [25,26]. In addition, another disadvantage of the acoustic methods was difficulty in eliciting the voice source, when the patients were highly aperiodic, to record the fundamental frequency [27]. Objective Acoustic analysis has the advantage to quantify the disability and measure it objectively.

Hence it was advised by many authors to combine the perceptual and acoustic evaluation methods for practical clinical diagnosis and evaluation of voice quality [27,28-30]. The GRBAS scale was used to objectively evaluate the characteristics of dysphonia before and after BT injections in this study. There were limitations to this study as it contained a small sample size, and was a single center study. These two factors might have lead to variation in the reporting when compared to other studies. But the high-quality study design and assessment of voice quality would have balanced the limitations.

Conclusions

Perceptual evaluation of voice quality in patients with SD done at admission and at follow up after Botulinum Injections was good and voice quality assessment tools like VAS, VHI and GRBAS showed high sensitivity and specificity. The final outcome of quality of voice was statistically significant when compared to placebo treatment.

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