Effect of Laryngeal Aspiration on Acoustic Voice Parameters

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Aim of Study

The purpose of this study was to investigate effect of penetration / aspiration (P/A) on voice acoustic parameters

Materials and Methods

All patients who were taken under videofluoroscopic swallowing study (VFSS) were categorized into two groups. 11 patients (5 men, 6 female) were included in the Non-P/A group, and 16 patients (12 men, 4 female) in the P/A group. Stroke in the groups was the major cause of swallowing disorders. A sustained vowel /a/ for at least 2 seconds was recorded before and after VFSS, and was analyzed using Multi-Dimensional Voice Program. Acoustic voice parame-

Table 1. Demographic data of study patients

Characteristics	Patients group	
	Non P_A group	P_A group
n	11	16
Sex, male / female	5/6	12/4
Age (yrs.) mean±SD	71.6±8.9	66.8±10.4
Range	56-83	49-86
Cause of dysphagia, n (%)		
Stroke	7	10
Medical disease	2	3
Head-neck cancer	0	2
Aging	0	1
Degeneration	2	0

Table 2. Five acoustic voice parameters before and after VFSS

Parameter	Pre-swallowing	Post-swallowing	p
Non_P/A group (n=11)			
mf0 (in male)	142.41±31.12	134.00±35.77	0.209
mf0 (in female)	166.88±28.75	170.76±45.81	0.889
RAP	1.12±0.79	2.46±1.90	0.091
Shimmer	8.27±5.59	13.71±5.65	0.054
NHR	0.21±0.08	0.35±0.18	0.031*
VTI	0.07±0.02	0.18±0.13	0.053
P/A group (n=16)			
mf0 (in male)	136.53±22.82	141.66±24.57	0.288
mf0 (in female)	145.74±20.50	141.48±34.61	0.722
RAP	2.39±2.58	2.93±3.48	0.379
Shimmer	11.22±4.46	11.47±6.43	0.715
NHR	0.27±0.13	0.31±0.20	0.29
VTI	0.13±0.08	0.13±0.08	0.608

Table 3. Differences in acoustic voice parameters before and after VFSS

Parameter	non_P/A group	P_A group	p
mf0 (in male)	8.41±12.58	-3.54±9.92	0.065
mf0 (in female)	3.88±58.48	11.88±50.29	0.713
RAP	-1.33±2.23	-0.70±2.77	0.584
Shimmer	-5.43±7.76	-0.49±4.72	0.072
NHR	-0.13±0.17	-0.03±0.12	0.134
VTI	-0.09±0.13	0.01±0.07	0.028*

Table 4. Classification accurary with five acoustic parameters

(in male)		Prediction		
		Groups		%
		Non P/A	P/A	
Groups	Non P/A	3	2	60.0
	P/A	1	9	90.0
Total percent				80.0

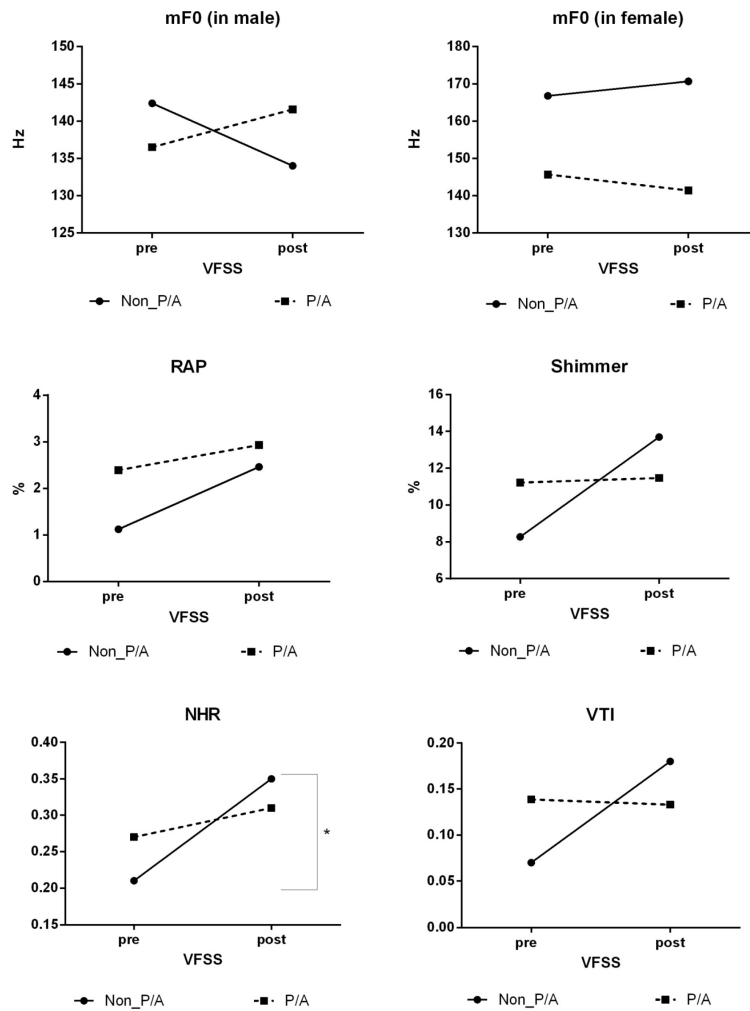| (in female)		Prediction		
		Groups		%
		Non P/A	P/A	
Groups	Non P/A	5	0	100.0
	P/A	0	3	100.0
Total percent				100.0

Fig. 1.

ters were five; mean F0, relative average perturbation (RAP), Shimmer, noise-to-harmonic ratio (NHR), and voice turbulence index (VTI). Independent t tests were used using SPSS 19 to compare the differences in 5 acoustic voice parameters between the Non_P/A and the P/A groups. Pre- and post-VFSS acoustic parameters within each group were evaluated with paired t test. Logistic regression was preformed to explore whether acoustic voice parameters can identify the presence of P/A.

Results

In the P/A group after VFSS, the values of mF0 (in male), RAP, Shimmer, NHR were increasing, but the values of mF0 (in female) and VTI were decreasing. Significant change was noted in the VTI parameter between two groups (p=0.028). Within the Non-P/A group, NHR (p=0.031) parameter had significant change after VFSS, however there was no significant difference within the P/A group. For male, classification accuracy was 80% by enter method with five acoustic parameters, and 100% in female.

Conclusion

Acoustic voice analysis can detect the changes of voice after swallowing. Also, the combination of several acoustic parameters may detect swallowing disorders.

Keywords

Swallowing disorders, Acoustic parameters, Voice