

# Laryngopharyngeal complaints following short-term endotracheal intubation: peculiarities of males and females

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**Background.** Laryngopharyngeal complaints are classified as minor post-intubation complications. They cause great discomfort, have some influence on the quality of life and can limit patient's casual activity. The extent of complaints ranges from 12 to 65%. Undesirable complications can be avoided by ascertaining factors that are able to provoke or decrease laryngopharyngeal symptoms after endotracheal intubation. In this study, we assessed predominant laryngopharyngeal symptoms following a short-term endotracheal intubation and their peculiarities subject to gender, and we estimated the most important influencing factors.

**Materials and methods.** 218 patients were examined before endotracheal anesthesia, 1–2 and 24 hours after extubation. The following laryngopharyngeal complaints were recorded: hoarseness, vocal fatigue, globus pharyngeus, throat pain and throat clearing. These factors were also assessed in relation to endotracheal intubation parameters: endotracheal tube size, cuff volume and pressure, number of intubation attempts, length of anesthesia, experience of anesthesiologist and additional parameters: smoking, allergy, GERD symptoms, laryngitis and singing skills subject to gender.

**Results.** All laryngopharyngeal symptoms increased significantly in 2 hours after extubation and remained increased after 24 hours in both male and female groups. In 1–2 hours after extubation, females complained of throat pain more than males (61.3 vs. 42.9%;  $p = 0,014$ ). The following significant relations were found 1–2 hours after extubation: between throat pain and length of anesthesia, globus pharyngeus and tube size and cuff volume in the male group; between globus pharyngeus, vocal fatigue and smoking, throat clearing and cuff volume in the female group. After 24 hours, the relation was noticed between vocal fatigue and cuff volume and number of intubation attempts, globus pharyngeus and length of anesthesia, between hoarseness and number of intubation attempts and between throat pain and singing skills in the male group. Some relation between throat clearing and cuff volume remained for 24 hours after extubation, smoking had influence on hoarseness and vocal fatigue in the female group.

**Conclusions.** Laryngopharyngeal symptoms remain an important cause of discomfort for 24 hours after extubation. Females complain of laryngeal and pharyngeal symptoms more than males and throat pain following extubation is also more frequent in females. The most important parameters of short-term endotracheal intubation that influence laryngopharyngeal complaints are as follows: cuff volume, length of anesthesia and number of intubation attempts that affect males more than females. Smoking affects females more, though singing skills are more significant in the male group.

**Key words:** endotracheal intubation, laryngopharyngeal symptoms, hoarseness, throat pain

## INTRODUCTION

Many years had passed since the first intubation, performed by the Scottish surgeon William McEwen in 1878 (1), and endotracheal intubation became a standard and casual procedure of general anesthesia (2). It is now a safe and effective procedure. However, despite such advantages as ventilation control, aspiration prevention, reduction of pulmonary dead space and easy access for airway suction, it still has some side effects (3). Laryngopharyngeal (LF) complaints are typical symptoms following general anesthesia (4). Throat pain, globus pharyngeus, vocal fatigue, throat clearing, hoarseness or even aphonia are all classified as minor post-intubation complications. They cause great discomfort, unpleasant remembrance, have an influence on the quality of life and can limit patient's casual activity. According to literature, the extent of complaints ranges from 12 to 65% (4). After the biggest study of 5,264 patients who underwent ambulatory operations, Higgins demonstrated that 45.4% of all patients complained of sore throat; while comparing genders, women were predominant: 13.4 vs. 9.1%, respectively (5). Undesirable complications can be avoided by ascertaining factors that are able to provoke or decrease LF symptoms after endotracheal intubation. The aim of this study was to notice and evaluate predominant LF complaints following short-term endotracheal intubation, to assess their peculiarities according to gender and to define the most important provoking factors.

## MATERIALS AND METHODS

This prospective study included 218 patients, treated in the ENT Center of Vilnius University Hospital Santariskiu Clinics from December 2009 to June 2011. All performed operations were scheduled for ear or nose pathology, patients underwent general anesthesia with endotracheal intubation. None of them were diagnosed with any disease of throat or larynx. Patients were examined at the day of operation before intubation and in 1–2 hours and 24 hours after extubation. LF symptoms assessed were as follows: hoarseness, vocal fatigue, globus pharyngeus, throat pain and clearing. Patients had to evaluate their complaints by answering “yes” or “no”, except throat pain, which was ranged from 0 to 10 points. Hoarseness was estimated as “yes” and

“no”, isolating easy and strong hoarseness. Other factors evaluated were smoking, allergy, symptoms of gastroesophageal reflux disease (GERD), frequent laryngitis (“yes” or “no”) and singing skills (“likes” or “dislikes to sing”).

The number of intubation attempts, the length of anesthesia in minutes, the size of the tube (inner tube diameter, mm), cuff volume (cm<sup>3</sup>) and pressure (cm H<sub>2</sub>O) were assessed. The experience of anesthesiologist was classified to resident doctor, young doctor with less than 5 years and experienced anesthesiologist having more than 5 years of practice.

The statistical analysis was performed using the SPSS 16.0 for Windows software statistics version (SPSS Inc., USA). The level of significance equal to 0.05 was chosen to check the hypothesis. The results were considered to be statistically significant when  $p < 0.05$ . The results were presented as the mean  $\pm$  standard deviation (SD) of the sample. The means of two independent groups were compared using the Chi square ( $\chi^2$ ) test and the Student's t-test. Nonparametric tests for dependent samples such as McNemar, Wilcoxon Signed-Rank tests and the Paired t-test were performed in order to compare the means of two groups. The bivariate analysis was then conducted between each of the anesthesia parameters and the significant outcomes of LF symptoms. These associations were examined using statistical tests as appropriate: Chi-squared and ANOVA.

## RESULTS

156 (71.6%) males and 62 (28.4%) females were examined before general anesthesia and the same number was examined in 1–2 hours and 24 hours after extubation. The age ranged from 10 to 77 years (mean age  $35.10 \pm 15.12$ ). All surgeries were done in general anesthesia, which lasted from 15 to 240 minutes (mean  $71.77 \pm 39.74$ ). The number of intubation attempts varied from 1 to 3 times. The size of the tube was from 5.5 to 8.5 for males and from 6.0 to 7.5 for females. The mean cuff pressure and volume were 32.98 cmH<sub>2</sub>O for males and 31.71 cmH<sub>2</sub>O for females, and 7.76 cm<sup>3</sup> for males and 6.65 cm<sup>3</sup> for females, respectively. The general mean body mass index (BMI) was  $25.04 \pm 4.58$  ( $25.48 \pm 4.47$  in males and  $23.3 \pm 4.71$  in females). 108 (49.5%) patients were operated for ear and 110 (50.5%) for nose pathology.

All of LF symptoms increased significantly in 1–2 hours after operation and remained after 24 hours. The statistical significance ( $p < 0.001$ ) did not differ comparing males and females for all symptomatic changes, except for males vocal fatigue in 24 hours after extubation ( $p = 0.016$ ). Females complained more of vocal fatigue, globus pharyngeus and throat clearing, while males complained about hoarseness before operation. The frequency of throat pain was equal in both groups. All symptoms increased following extubation equally in male and female groups, except throat pain in 1–2 hours after extubation (Table 1).

Significant differences were found comparing means of LF symptoms for males and females before intubation, 1–2 and 24 hours after extubation. Females experience globus pharyngeus more than

males before operation (9.7 vs. 3.2%). 1–2 hours after extubation, females complained of throat pain more than males (61.3 vs. 42.9%), and in 24 hours after operation these parameters nearly equaled (41.9 vs. 40.4%) but did not reach initial values. Neither males nor females complained of vocal fatigue, consequently this parameter was not included into the table (Table 1).

Smoking, symptoms of GERD, allergy, frequency of laryngitis and singing skills differed markedly between groups. Males smoked significantly more comparing to females, while females tended to have laryngitis and predilection for singing. Females more often complained about GERD symptoms and allergies; however, the difference was not significant (Table 2).

**Table 1.** Means of males and females LF symptoms before intubation, 1–2 hours and 24 hours after extubation

	Male (n = 156)	Female (n = 62)	All (n = 218)	P value
<b>Hoarseness</b>				
Before intubation	8 (5.1%)	1 (1.6%)	9 (4.1%)	0.144
1–2 h after extubation	127 (81.4%)	52 (83.9%)	178 (81.7%)	0.671
24 h after extubation	80 (51.3%)	30 (48.4%)	110 (50.5%)	0.701
<b>Vocal fatigue</b>				
1–2 h after extubation	40 (25.6%)	23 (37.1%)	63 (9.2%)	0.092
24 h after extubation	13 (8.3%)	7 (11.3%)	20 (13.8%)	0.495
<b>Throat clearing</b>				
Before intubation	19 (12.2%)	11 (17.7%)	30 (13.8%)	0.282
1–2 h after extubation	101 (64.7%)	39 (62.9%)	140 (64.2%)	0.798
24 h after extubation	71 (45.5%)	32 (51.6%)	103 (47.2%)	0.454
<b>Globus pharyngeus</b>				
Before intubation	5 (3.2%)	6 (9.7%)	11 (5.0%)	0.049*
1–2 h after extubation	78 (50.0%)	29 (46.8%)	107 (49.1%)	0.667
24 h after extubation	37 (23.7%)	16 (25.8%)	53 (24.3%)	0.746
<b>Throat pain</b>				
Before intubation	7 (4.5%)	3 (4.8%)	10 (4.6%)	0.911
1–2 h after extubation	67 (42.9%)	38 (61.3%)	105 (48.2%)	0.014*
24 h after extubation	63 (40.4%)	26 (41.9%)	89 (40.8%)	0.834

\*P value < 0.05.

**Table 2.** Comparison of smoking, GERD symptoms, laryngitis, allergy and singing skills in males and females groups

	Male (n = 156)	Female (n = 62)	P value
Smoking	53 (34.0%)	10 (16.1%)	0.009*
GERD symptoms	35 (22.4%)	19 (30.6%)	0.205
Allergy	19 (12.2%)	12 (19.4%)	0.171
Morbidity of laryngitis	6 (3.8%)	9 (14.5%)	0.005*
Singing skills	55 (35.3%)	32 (51.6%)	0.026*

\* P value < 0.05.

Significant relations were found when estimating the influence of endotracheal intubation, smoking, allergy, laryngitis, GERD symptoms and singing skills for LF symptoms of males and females: between throat pain and length of anesthesia, globus pharyngeus, tube size and cuff volume after 2 hours for males; between globus pharyngeus, vocal fatigue and smoking, throat clearing and cuff volume for females (Table 3). 24 hours after extubation, the following relations were noticed: between vocal fatigue and cuff volume and number of intubation attempts, globus pharyngeus and length of anesthesia, between hoarseness and number of intubation attempts, throat pain and singing skills for males;

between throat clearing and cuff volume, smoking and hoarseness and vocal fatigue for females (Table 4). No significant relation was found between experience of anesthesiologist and LF complaints (Table 3, 4). Allergy, laryngitis and symptoms of GERD did not have any significant influence on post-intubation LF complaints; therefore they were not included into the tables (Table 3, 4).

## DISCUSSION

Our results, received comparing LF complaints in 1–2 hours after short-term endotracheal intubation, range about 25–80% and are slightly bigger

**Table 3.** Influence of parameters of endotracheal intubation, smoking and singing skills on changes of LF symptoms in males and females 1–2 hours after extubation in comparison to the baseline (P value is presented)

	Hoarseness		Vocal fatigue		Throat clearing		Globus pharyngeus		Throat pain	
	M	F	M	F	M	F	M	F	M	F
Duration of anaesthesia	0.873	0.985	0.415	0.685	0.927	0.238	0.182	0.917	0.001*	0.985
No. of intubation attempts	0.801	0.995	0.396	0.277	0.917	0.924	0.842	0.940	0.984	0.995
Tube No.	0.769	0.142	0.291	0.732	0.345	0.413	0.002*	0.718	0.643	0.142
Cuff volume	0.558	0.337	0.375	0.413	0.374	0.044*	0.002*	0.063	0.846	0.337
Cuff pressure	0.193	0.748	0.794	0.262	0.137	0.532	0.130	0.904	0.279	0.748
Experience of anaesthesiologist	0.551	0.921	0.821	0.644	0.727	0.827	0.472	0.573	0.063	0.921
Smoking	0.090	0.586	0.354	0.018*	0.314	0.631	0.513	0.003*	0.490	0.703
Singing skills	0.511	0.458	0.767	0.947	0.791	0.185	0.780	0.857	0.610	0.057

\*P value < 0.05.

**Table 4.** Influence of parameters of endotracheal intubation, smoking and singing skills on changes of LF symptoms in males and females 24 hours after extubation in comparison with the baseline (P value is presented)

	Hoarseness		Vocal fatigue		Throat clearing		Globus pharyngeus		Throat pain	
	M	F	M	F	M	F	M	F	M	F
Duration of anaesthesia	0.790	0.514	0.135	0.192	0.828	0.500	0.016*	0.428	0.320	0.751
No. of intubation attempts	<0.001*	0.416	0.001*	0.615	0.911	0.910	0.441	0.634	0.376	0.865
Tube No.	0.733	0.353	0.079	0.113	0.212	0.867	0.082	0.824	0.879	0.665
Cuff volume	0.087	0.965	0.008*	0.311	0.950	0.035*	0.126	0.199	0.223	0.604
Cuff pressure	0.986	0.969	0.584	0.517	0.979	0.523	0.820	0.946	0.237	0.390
Experience of anaesthesiologist	0.989	0.372	0.454	0.481	0.655	0.079	0.257	0.473	0.517	0.834
Smoking	0.366	0.038*	0.723	0.042*	0.252	0.969	0.345	0.177	0.109	0.881
Singing skills	0.105	0.297	0.622	0.629	0.475	0.606	0.615	0.532	<0.001*	0.880

\* P value < 0.05.

than those described in other studies (14–75%) (6–12). This percent of post-intubation complaints was registered in 1–2 hours after extubation, whereas the majority of authors such as Higgins in the study with 5,264 patients (5) and Biro in the study with 809 patients (3) examined patients in 24 hours after extubation. The percent of LF complaints in 24 hours after extubation decreased to 8–50% and thus corresponds to literature.

In 1–2 hours after operation, patients complained mostly of hoarseness (81.7%), throat clearing (64.2%), globus pharyngeus (49.1%) and throat pain (48.2%). After 24 hours, the percent of the patients decreased but remained significantly higher; hoarseness and throat clearing were dominant, throat pain (40.8%) caused more discomfort than globus pharyngeus (24.3%) (Table 1). The percent of complaints in 2 hours after extubation was slightly lower in Hamdan's study of 35 patients (13). The dominant symptoms were as follows: throat pain (52.9%), aphonia (50.0%), throat clearing (38.2%), vocal fatigue (35.3%). In 24 hours after extubation, all these symptoms decreased to insignificant values. Differences of the data in this study could be interpreted according to the type of surgery performed. In Hamdan's study, 46% of patients underwent surgeries of thorax and abdomen, others underwent arthroscopic and ophthalmologic treatments, therefore the condition of patients was more severe and they had more post-intubation complaints. In our study, patients were operated for ear and nose pathology and could be more concentrated on LF symptoms.

According to the literature, females complain of LF symptoms more than males after intubation (3, 5, 7–9, 12, 14, 15). This was demonstrated in our study as well: in 1–2 hours after extubation significantly more females complained of throat pain ( $p = 0.014$ ). After 24 hours, this difference was not so strong, but females remained dominant. However, the reason of these differences remains unknown. Some authors explain this as hormonal difference or their fluctuation (16, 17), while others claim it depends on women tendency to elaborate their complaints (17). This could be the explanation for the significant difference we found between globus pharyngeus before operation in male and female groups ( $p = 0.049$ ).

The influence of smoking for LF symptoms is evident in our study, despite the fact that the percent of

smoking females is lower than males. Smoking females mostly complained of vocal fatigue after endotracheal anesthesia. Biro (3) in the study of 809 patients found that smoking increased post-operative throat pain. Other authors did not mention such relation (9, 18). Results should be measured more precisely in a bigger study as the amount of smoking women in our study was not big enough.

The length of anesthesia, the number of intubation attempts are all proved factors influencing LF complaints (9, 11) that are confirmed in our study as well and affect males more than females. However, some authors do not find such relation (6–8). Biro (3), who assessed the anesthesiologist's experience, did not find any significant relation between LF complaints after intubation and the experience of anesthesiologist, and claimed that no improvement in the work of anesthesiologist could be detected in one year after clinical practice (3, 19).

Assessing the influence of endotracheal intubation, it appears that the cuff volume influences LF symptoms most. 1–2 hours and 24 hours after extubation, the cuff volume caused vocal fatigue in the female group, globus pharyngeus 1–2 hours after and vocal fatigue 24 hours after extubation in the male group. Similar results were demonstrated by Hamdan (13) in 2 hours after intubation: the cuff volume mostly affected vocal fatigue, though the author did not divide patients according to their gender.

When the volume of the cuff increases, the contact area of the cuff and trachea increases as well, mucosal perfusion worsens because of increase in the pressure of the contact area, especially if the cuff pressure exceeds the pressure of perfusion of tracheal capillaries ( $>39 \text{ cmH}_2\text{O}$  or  $>30 \text{ mmHg}$ ), consequently causing mucosal ischemia, edema and necrosis (13, 20). Thus, the recommended safe tube cuff pressure should not exceed  $26 \text{ cmH}_2\text{O}$  or  $20 \text{ mmHg}$  (21). In our study, the cuff pressure exceeded  $30 \text{ cmH}_2\text{O}$  in both male and female groups, therefore though no direct relation was found between the cuff pressure and LF symptoms, indirect influence on vocal fatigue and globus pharyngeus was possible. There is another problem associated with the cuff of the tube: if its diameter is bigger than the tracheal width, the excess of the cuff surface may shrivel. These folds impress deep ditches in the mucosal layer, causing its damage. Thus, it is recommended that proper tube cuff should be

slightly less wide in diameter comparing to the trachea and made of the material allowing 10% growth in diameter (when the pressure inside is 20–30 cmH<sub>2</sub>O) to prevent shriveling (21).

The most unexpected findings were obtained assessing the influence of singing skills. Usually females liked singing more than males ( $p = 0.026$ ), nevertheless in 24 hours after extubation singing males were more sensitive to throat pain ( $p < 0.001$ ). It proves the fact that vocal cords are very sensitive anatomic structures, therefore intubation should be more delicate for professional singers: in order to avoid even slight mucosal traumatizing, the tube size should be smaller (7.0 for males and 6.0 for females) than usual and intubation should be performed by the experienced anesthesiologist (22).

## CONCLUSIONS

1. LF symptoms are frequent complaints following endotracheal intubation, and though being innocuous, they remain a significant cause of discomfort in 50.5% of patients even 24 hours after extubation.

2. Females complain of LF symptoms more than males; post-extubation throat pain is significantly more common in the female group.

3. The most important parameters of endotracheal intubation that influence LF complaints are as follows: cuff volume, length of anesthesia and number of intubation attempts that influence males more than females.

4. Smoking is an additional factor, which is directly associated with post-intubation vocal fatigue, globus pharyngeus and hoarseness. Post-intubation throat pain was more characteristic for males with singing skills.

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#### FARINGOLARINGINIAI NUSISKUNDIMAI PO TRUMPALAIKĖS ENDOTRACHĖJINĖS INTUBACIJOS: MOTERŲ IR VYRŲ YPATUMAI

##### *Santrauka*

**Įvadas.** Faringolaringiniai nusiskundimai, priskiriami mažosioms pointubacinėms komplikacijoms, sukelia diskomfortą, veikia paciento gyvenimo kokybę, gali riboti kasdienę jo veiklą. Nusiskundimų skaičius svyruoja nuo 12 iki 65 %. Išsiaiškinus veiksnius, galinčius sukelti ar sumažinti faringolaringinius simptomus po endotrachėjinės intubacijos, galima išvengti nepageidaujamų komplikacijų ir pagerinti paciento savijautą bei komfortą po intervencijos. Šioje studijoje mes įvertinome vėraujančius balso ir gerklės simptomus po trumpalaikės endotrachėjinės intubacijos, jų ypatumus priklausomai nuo lyties ir nustatėme svarbiausius juos lemiančius veiksnius.

**Tyrimo medžiaga ir metodai.** Ištirta 218 pacientų prieš endotrachėjinę nejautrą, praėjus 1–2 val. ir 24 val. po ekstubacijos. Nustatyti šie faringolaringiniai nusiskundimai: užkimimas, balso nuovargis, *globus pharyngeus*, gerklės skausmas, noras atsikrenkšti. Įvertintas ryšys tarp šių rodiklių ir endotrachėjinės intubacijos parametrų: intubacinio vamzdelio dydžio, manžetės tūrio, slėgio, intubacijos bandymų skaičiaus, anestezijos trukmės, anesteziologo patirties bei papildomų parametrų – rūkymo, alergijos, GERL simptomų, sergamumo laringitu, dainavimo įgūdžių, lyties.

**Rezultatai.** Visi faringolaringiniai simptomai statistškai patikimai išryškėjo praėjus 2 val. ir išliko tiek vyrams, tiek ir moterims praėjus 24 val. po ekstubacijos. Po 1–2 val. moterys dažniau nei vyrai skundėsi gerklės skausmu (61,3 ir 42,9 %;  $p = 0,014$ ). Po 1–2 val. nustatytas reikšmingas ryšys: vyrams – tarp gerklės skausmo ir anestezijos trukmės, *globus pharyngeus* ir intubacinio vamzdelio dydžio bei manžetės tūrio; moterims – tarp *globus pharyngeus*, balso nuovargio ir rūkymo, noro atsikrenkšti ir manžetės tūrio; po 24 valandų vyrams – tarp balso nuovargio ir vamzdelio manžetės tūrio bei intubacijos bandymų skaičiaus, *globus pharyngeus* ir anestezijos trukmės, tarp užkimimo ir intubacijos bandymų skaičiaus, gerklės skausmo ir dainavimo įgūdžių; moterims ryšys tarp noro atsikrenkšti ir manžetės tūrio išliko ir po 24 val., o rūkymas turėjo įtakos užkimimui bei balso nuovargiui.

**Išvados.** Praėjus 24 val. po ekstubacijos faringolaringiniai simptomai išlieka reikšminga diskomforto priežastimi. Moterys dažniau nei vyrai skundžiasi balso ir gerklės simptomais, joms dažniau nei vyrams po ekstubacijos skauda gerklę. Svarbiausi trumpalaikės endotrachėjinės nejautos parametrai, lemiantys faringolaringinius nusiskundimus – intubacinio vamzdelio manžetės tūris, anestezijos trukmė, intubacijos bandymų skaičius, daro didesnę poveikį vyrams nei moterims. Rūkymas labiau paveikia moteris, o dainavimo įgūdžiai yra reikšmingesni vyrams.

**Raktažodžiai:** endotrachėjinė intubacija, faringolaringiniai simptomai, užkimimas, gerklės skausmas