THE ROLE OF HEAT AND MOISTURE EXCHANGER IN POSTLARYNGECTOMY QUALITY OF LIFE

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Aim: The aim of this study was to investigate the effect of heat and moisture exchanger use on everyday problems and quality of life aspects in laryngectomized patients. ***Methods:*** Seventy laryngectomized patients were included and divided into a control group that used no device, and a group equipped with a heat and moisture exchanger. The effect of the heat and moisture exchanger was evaluated by means of a specially designed questionnaire. Medical records were reviewed to collect demographic, health, behavior, tumor and surgical data. Assessment of the benefits and drawbacks of the device was made by statistical comparison of the control group and the group using the device. ***Results:*** the group using the device scored significantly better on the questions about verbal communication, social interaction, paying attention and concentration. ***Discussion:*** The results of this study suggest that the use of heat and moisture exchanger can effectively reduce psychosocial and physical problems after total laryngectomy. A review of medical literature and comparison of the results of this study with the literature data available shows that the use of heat and moisture exchanger influences particular aspects of the quality of life of laryngectomized persons. ***Conclusion:*** the heat and moisture exchanger cannot fully restore physiological functions of the upper respiratory tract, but it plays an important role in the prevention of symptoms and in pulmonary and psychosocial rehabilitation after laryngectomy.

Key words: heat and moisture exchanger, laryngectomy, rehabilitation, quality of life

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INTRODUCTION

Laryngeal cancer and its treatment change some of the most important and vital functions such as oral communication, breathing, feeding, and social interaction. Total laryngectomy is still the treatment of choice for advanced laryngeal carcinoma. Complete removal of the larynx results in complete disconnection of the upper and lower respiratory tract, the voice organ is lost, and breathing through the tracheostoma leads to chronic lung problems. In addition, laryngectomees complain of a reduced sense of taste and smell, swallowing problems, fatigue, sleeping problems, anxiety and depression (1). These lifelong functional and psychosocial consequences have a devastating effect on patients and their families, and significantly influence the quality of life (QOL) of these patients. Rehabilitation of these patients has long been a major challenge, but in the last three decades restoration of function and QOL has become as important as cure and survival (2). Voice rehabilitation is individual and, in the past, included two methods, i.e. esophageal and electrolaryngeal speech. For the last 30 years, tracheoesophageal speech using voice prosthesis has become the most preferred method in voice restoration following total laryngectomy (3-5). Different techniques have been developed for improvement of olfaction in laryngectomees (6). At present, the only effective

non-pharmaceutical method of pulmonary rehabilitation following total laryngectomy is regular use of heat and moisture exchangers (HME). These devices are designed to help laryngectomees regain some of the lost functions, a role normally played by the upper respiratory tract (7). Daily consecutive use of an HME contributes to a healthier respiratory tract, restores airway resistance, and helps maintain optimal lung ventilation (8). The HME that are available to our patients are synthetic open-cell foam discs, impregnated with hygroscopic salt in order to increase its humidifying power, and antibacterial substance. Filters are placed over the tracheostoma by peristomal adhesion, in a special holder, and should be replaced at least once a day. These devices have a triple function, i.e. warming and humidifying the inspired air, and removing particles. The filter also increases airway resistance (9).

THE AIM OF STUDY

The main objectives of the research were to describe the problems of patients who had undergone total laryngectomy as a treatment for laryngeal cancer, and to investigate the effect of HME use on some factors influencing the QOL in laryngectomized patients.

METHODS

Testing was conducted on a sample of 70 totally laryngectomized patients of both genders. Thirty-five of them were regular users of HME (experimental group to test the HME, HME group) from two manufacturers whose cassettes are available in Croatia (Blom-Singer HME Cartridge and Provox HME Cassette) and 35 of them were non-users (no-treatment, control group). According to composition, the main part of the HME consists of a porous foamy substance that acts as a condensation and absorption surface, and is impregnated with hygroscopic salts and bactericidal solution. The Blom-Singer HME cartridge consists of a foam filter impregnated with chlorhexidine and lithium chloride. Provox HME cassettes also consist of a foam filter impregnated with calcium chloride and an antibacterial substance. Regular users had been using HME for at least one year. All of them had undergone total laryngectomy for laryngeal carcinoma combined with neck dissection at least one year before. All patients received radiotherapy postoperatively. Speech rehabilitation was conducted in all of them, and they are good alaryngeal speakers. They had been heavy smokers but none of them continued smoking following laryngectomy. Patients with a history of chronic lung disease before laryngectomy were excluded from the trial. None of the patients exhibited clear signs of active pulmonary infection. The state of general health was good in all study patients. All patients were informed about the aims of the study and all volunteered to take part in it. They were asked to complete a questionnaire to obtain their clinical history. Data were requested concerning current and previous lung diseases and other diseases related to pulmonary function, as well as on previous smoking habits. The experimental group evaluated the HME effectiveness. Medical records were reviewed to collect demographic, health, tumor and surgical data. The effect of HME was evaluated by means of a self-designed questionnaire. The first group of questions was a simple symptom score questionnaire. It contains ten questions intended to assess the impact of specific symptoms on daily life (1 – insufficient, 2 – sufficient, 3 – good, 4 – very good, 5 – excellent). The second group of questions evaluated some psychosocial problems and their frequency, as well as their impact on QOL (never, sometimes, always).

The benefits and drawbacks of the device were assessed by statistical comparison between the control group and the group using the device.

RESULTS

The study included 70 laryngectomized patients, nine (12.86%) of them women and 61 (87.14%) men, randomized to the HME (n=35) or control (n=35) group. The mean age of the HME group was 63.69±8.64 years, and of the control group 63.43±7.20 (median 62 min. 51, max. 89 **vs**. median 61 min. 50, max. 79, z=-0.100, p=0.920). There was no statistically significant age difference between the HME and control group. All patients had been heavy smokers, with a mean tobacco consumption of 38.17±12.51 years in the HME group and 38.15±8.91 years in the control group. We found no statistically significant between-group difference in the time elapsed from total laryngectomy. The mean time elapsed from the surgery was 5.37±3.81 years in the HME group and 5.31±4.68 in the control group (median 5, min. 1, max. 14 **vs**. median 5, min. 1, max. 28, z=-0.118, p=0.906) (Table 1). Voice rehabilitation of respondents from both groups was analyzed. Of the total number of respondents, 48 (69%) were speaking tracheoesophageally, 17 (24%) esophageally and 5 (7%) by electrolarynx. HME cassettes were statistically significantly more often used by those speaking tracheoesophageally (χ^2=13.226; p<0.001); there was no statistically significant difference between the groups for other methods of speech rehabilitation.

Table 2 shows patient rating of their problems and symptoms. Both groups equally evaluated the examined symptoms. They had no major problems with pain, dry mouth, breathing, nasal secretion, swallow-

ing and speech, but had problems with smell and taste, coughing and expectoration. Contrary to expectations, there was no significant between - group difference for most of the examined parameters in the perceived problems and symptoms. A statistically significant difference between the two groups was recorded in pain (χ^2=8.400; p=0.021) and taste (χ^2=11.076; p=0.020), i.e. results were significantly better in the HME group.

In the second group of questions, respondents evaluated the prevalence of certain parameters related to daily functioning (oral communication, social interaction, concentration and attention, sleeping, fatigue and weakness, loss of appetite, concern about health, depression and sadness). The majority of patients reported that they had never had any problems with sleeping (64.29%), appetite (81.43%), depression (72.86%), and concentration and attention (62.86%). Statistically significantly better results were recorded for oral communication (χ^2=10.809; p=0.004), social interaction (χ^2=16.533; p=0.001), and concentration and attention (χ^2=6.513; p=0,030) in the HME group. Overall, all HME users were very positive about the HME effects. Twenty of them (57.14%) rated it as excellent, 12 (34.29%) as very good, and three (8.57%) as good.

DISCUSSION

Obviously, treatment outcomes and overall survival remain the key issues in the evaluation of therapy effectiveness and QOL assessment is needed to put the loss of function into perspective and to evaluate the effectiveness of specific treatments and solutions (10). Patient perception of change in the overall QOL after total laryngectomy differs from the physician's. Mohide *et al.* performed a study comparing the relative importance of various QOL dimensions as ranked by patients and health care professionals. Health care professionals ranked communication impairment as the most important dimension, and patients ranked physical consequences and social activities as the most important QOL dimensions (11). In the recent past, the main attention of postlaryngectomy rehabilitation was paid to voice rehabilitation, while relatively little attention was paid to pulmonary rehabilitation according to the literature. The loss of normal voice was the predominating problem after total laryngectomy (12). However, it is clear that total laryngectomy has a profound impact on the patient daily living in many ways. Proper function of the upper airway is known to be highly important because it has the role of protecting the lungs, humidifying and conditioning the air before reaching the trachea, preventing dehydration of secretions, and facilitating mobilization (13).

In this study, less expected was the finding that olfactory deterioration was a major problem in all subjects. This fact has important implications for future efforts to improve rehabilitation of smell after total laryngectomy. Statistical comparisons failed to detect any significant differences between the HME and control groups in respiratory symptoms, speech, swallowing and nasal secretion, but HME group had significantly better results in the sense of taste and pain. However, in a study by Gonzalez *et al.,* an increase in humidity was observed after one hour of wearing the HME cassette. In all subjects, the HME cassette provided hydration >37 mg H_2O/L and patency of the endotracheal tube; however, it should be noted that their study included only 10 respondents (14). In this study, HME group also showed significantly better results in some parameters related to daily functioning, i.e. oral communication, social interaction, and concentration and attention. Some patients reported that they used to cover their tracheostoma because of aesthetic and hygienic reasons.

CONCLUSION

Results of this study suggest that the use of fan HME can effectively reduce some psychosocial and physical problems following total laryngectomy. HME cannot completely restore physiological functions of the upper airway, but plays an important role not only in pulmonary rehabilitation but also in psychosocial rehabilitation, as well as returning to normal life after total laryngectomy. This study also highlighted the functional and psychological difficulties, stimulating healthcare professionals to develop improved standards of care for patients after total laryngectomy.

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SAŽETAK

ULOGA KAZETA ZA ODRŽAVANJE VLAŽNOSTI I TEMPERATURE ZRAKA U KVALITETI ŽIVOTA NAKON LARINGEKTOMIJE

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Cilj: **Ispitati ulogu kazeta za održavanje vlažnosti i temperature zraka u smanjenju svakodnevnih problema i u nekim aspektima kvalitete života laringektomiranih bolesnika. *Metode:* Sedamdeset laringektomiranih bolesnika uključenih u istraživanje podijeljeni su u kontrolnu skupinu koja ne rabi kazete za održavanje vlažnosti i temperature zraka i skupinu ispitanika koja ih rabi. Uloga kazeta za održavanje vlažnosti i temperature zraka procijenjena je pomoću posebno osmišljenog upitnika. Pregledana je medicinska dokumentacija te su dobiveni demografski i zdravstveni podatci, podatci o navikama te podatci o tumoru i liječenju. Procjena prednosti i nedostataka ovog pomagala učinjena je statističkom usporedbom kontrolne skupine i skupine ispitanika. *Rezultati:* Ispitivana skupina je statistički značajno bolje ocijenila verbalnu komunikaciju, društvenu interakciju, pozornost i koncentraciju. *Rasprava:* Rezultati ovoga istraživanja ukazuju na to da upotreba kazeta za održavanje vlažnosti i temperature zraka može učinkovito smanjiti psihosocijalne i fizičke probleme nakon totalne laringektomije. Pretraživanje medicinske literature i usporedba rezultata ovoga istraživanja s dostupnim publiciranim podatcima pokazuje da upotreba kazeta za održavanje vlažnosti i temperature zraka utječe na određene aspekte kvalitete života laringektomiranih osoba. *Zaključak:* Kazeta za održavanje vlažnosti i temperature zraka ne može u potpunosti obnoviti fiziološke funkcije gornjeg dišnog puta, ali ima važnu ulogu u prevenciji simptoma te u plućnoj i psihosocijalnoj rehabilitaciji nakon laringektomije.**

Ključne riječi: **kazeta za održavanje vlažnosti i temperature zraka, kvaliteta života, laringektomija, rehabilitacija**