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Original research

Spirometry in elderly laryngectomized patients: A feasibility study

Alessandro Izzo [a], Fabio Perrotta [a], Antonio Cennamo [a], Francesco Saverio Cerqua [a], Luca Rinaldi [a], Antonio Mazzella [b], Edoardo Grella [a], Carmelindo Tranfa [a], Andrea Bianco [a, *], Francesco Stefanelli [c], Gennaro Mazzarella [a]

[a] Department of Cardiothoracic and Respiratory Sciences, Second University of Naples, Dei Colli Hospital, Via Leonardo Bianchi, 80131, Naples, Italy
[b] Division of Thoracic Surgery, A.O. Dei Colli Monaldi Hospital, Naples, Italy
[c] Division of Pneumology, A.O. Dei Colli Monaldi Hospital, Naples, Italy

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ABSTRACT

Background: Laryngeal cancer is the second most common respiratory neoplasm after lung cancer. Laryngectomy is a well established treatment for larynx cancers which involve relevant anatomic alterations. Spirometry is an essential investigation tool for diagnosis and severity of respiratory diseases, difficult to perform in laryngectomees.

Methods: 43 consecutive laryngectomized patients were enrolled from July 2014 to March 2015. Patients fulfilling inclusion criteria underwent spirometry at baseline assessment and after two days. During the examination, the spirometer was placed directly on the stoma of the patient, through mouthpiece "Spirometry Filter 74".

Results: At baseline, 26 eligible laryngectomees correctly performed the spirometry test with mouthpiece adhering to the stoma; 4 patients refused to perform the second spirometry after 2 days. The feasibility of spirometry examination in these patients was 100% despite difficulties in the execution of the test. The Pearson coefficient of reproducibility for FEV1, FVC and Tiffeneau Index was, respectively, 0.98, 0.94 and 0.77.

Discussion: Spirometry in laryngectomee patients is a feasible procedure for assessment of respiratory function; despite technical difficulties in the execution of the test, our results underline the reproducibility and repeatability of the spirometry. In conclusion, when performed within dedicated respiratory pathophysiology unit, spirometry is a reliable tool in the assessment and follow up of laryngectomees.

1. Introduction

Laryngeal cancer is the second most common respiratory neoplasm after lung cancer [1]. Major risk factors for respiratory cancers are environmental pollution and tobacco smoking; heavy alcohol use and infection with the human papillomavirus (HPV) further increase the risk of head and neck cancers [2–7]. Laryngeal cancer becomes more common with age and is more frequent in men than in women; median age at diagnosis is 65 years. Clinical manifestation of larynx cancer depends mainly on the size and location of the tumor and symptoms may be common to other respiratory and ear-nose-throat diseases [8–12]. Despite advances in cancer biology [13–29], surgery remains the mainstay of treatment in the majority of neoplasms. Laryngectomy is a well established treatment for larynx cancers. Total laryngectomy is a radical mutilating surgery for laryngeal cancers that involves the removal of the larynx, resulting in anatomical and functional changes in the respiratory system due to air flowing through the tracheal stoma and thus by-passing the nasal filter. It is achieved by bringing the trachea to the skin in the lower anterior cervical area. This leads to voice loss and alteration of other activities related to the integrity of pneumo-phonic coordination, such as coughing, laughing, whistling, sneezing and blowing nose [30]. As laryngeal cancers frequently arise in patients with chronic lung diseases, respiratory functional monitoring is relevant for patient management. Spirometry is a test designed to measure functional capacity of the

* Corresponding author.
E-mail addresses: aleizzo85@yahoo.it (A. Izzo), perrotta572@msn.com (F. Perrotta), antonio.cennamo@yahoo.it (A. Cennamo), fscerqua@hotmail.it (F.S. Cerqua), lucarinaldi@tin.it (L. Rinaldi), antonio.mazzella86@gmail.com (A. Mazzella), edoardogrella@unina2.it (E. Grella), carmelindotranfa@unina2.it (C. Tranfa), andrea.bianco@unina2.it (A. Bianco), francescostefanelli@hotmail.com (F. Stefanelli), gennaro.mazzarella@unina2.it (G. Mazzarella).

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respiratory system. Spirometry can be performed using different types of instruments; the procedure requires cooperation between patient and examiner, and the results will depend on both technical expertise and patient collaboration [31,32]. In laryngectomees spirometry examination has technical limitations related to the anatomic alterations due to radical surgery [33]. Disrupted interface between spirometer and stoma, poor performance of devices connecting to the cuffed cannula, discomfort caused to the patient by adhesive devices (panic, allergic reactions) are major factors which affect execution and interpretation of the spirometry test [34–36]. In laryngectomees results should be assessed and validated by an expert panel before being interpreted [37–39] and reproducibility is vital to achieve accurate measurements. Therefore individual test measurements should be obtained under the same conditions, including same method, same instrument, same observer, same location, and repeated over a short period of time [40]. In literature, there are a few data regarding feasibility, reproducibility and repeatability of this functional test in laryngectomy patients. In this study we have evaluated the feasibility, reproducibility and repeatability of spirometry in a group of elderly patients with laryngeal cancer who underwent total laryngectomy.

2. Material and methods

From July 2014 to March 2015, 43 consecutive patients reviewed in outpatients unit of the Department of Cardiothoracic and Respiratory Sciences of SUN (Second University of Naples) with total laryngectomy for laryngeal cancer were enrolled in the study. All patients gave informed consent. The patients were required to fulfill the following inclusion criteria:

- Total laryngectomy
- Confirmed histology diagnosis of laryngeal cancer
- Age >65 years
- Absence of any respiratory infection during the 2 weeks preceding the study
- Absence of recurrence or metastatic disease
- Absence of any other concurrent neoplasm

Twenty-six subjects fulfilled all inclusion criteria and were eligible for the study. The age of laryngectomy patients ranged from 65 to 81 years with a median age of 74.1 years; all laryngectomees were ex-smokers and underwent surgery for the removal of a laryngeal cancer between 2004 and 2013. Patients characteristics are reported in Table 1. All eligible laryngectomees were required to perform spirometry test with mouthpiece adhering to the stoma at baseline. The test was repeated after two days. To assess feasibility of spirometry examination in laryngectomees the data obtained from baseline procedure were considered. To evaluate reproducibility and repeatability of the test data from patients who correctly repeated the test after two days were analyzed. All examinations were performed with the same spirometer and without extra - tracheal "device". Spirometry was performed with the spirometer "Spirometry Power unit" and the use of the mouthpiece "Spirometry Filter 74". During the examination, the spirometer was placed directly on the stoma of the patient, exerting an adequate pressure to avoid air leaking and consequently bias in the analysis.

Table 1
Anthropometric data.

Patients enrolled	43
Patients eligible	26
Age (years)	
Median	74.1
Range	65–81
Gender	
Male	14
Female	12
Smokers	100%
Weight (Kg)	
Median	58
Range	45–95
Height (cm)	
Median	165
Range	155–185
BMI	
Median	23
Range	17.2–28.4

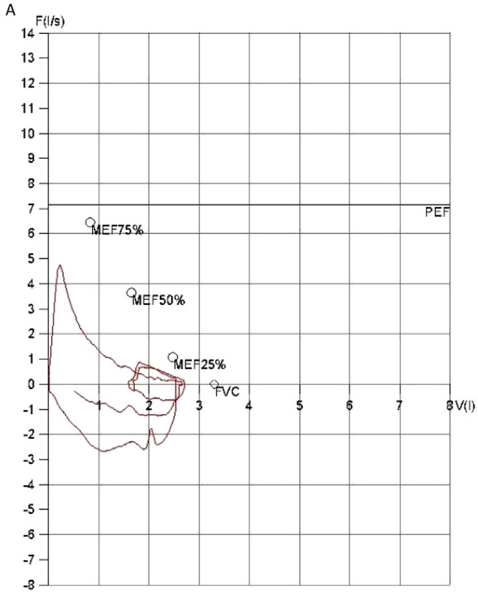
3. Statistical analysis

The reproducibility of spirometry test was calculated with the Pearson coefficient of reproducibility and represented graphically with the regression line. The repeatability, however, was calculated with the coefficient of repeatability of Bland – Altman.

4. Results

At baseline, 26 laryngectomees recruited performed correctly the spirometry test with mouthpiece adhering to the stoma; 4 patients refused to perform the second spirometry after 2 days. To assess feasibility of spirometry examination in laryngectomee patients we considered the data obtained on 26 patients who performed at least one spirometry test. For the study of reproducibility and repeatability, however, we considered the data obtained from 22 laryngectomee patients who repeated the test after two days. All 26 eligible laryngectomees performed spirometry test at baseline; 4 patients refused to perform the second spirometry after 2 days. Fig. 1reports the mean value of FEV1 FVC and Tiffaneau index. Despite difficulties in the implementation of the test all twenty-six

A



B

	Percentage Value Compared to Predicted
FEV1	78,2 ± 8
FVC	85,4 ± 7,8
Tiffenau Index	68,4 ± 6,6

Fig. 1. A – Representative Flow/Volume curv in laringectomee at baseline. B – Spirometry Mean Values at baseline.