CASE REPORTS

Spirometric Evaluation of Respiratory Involvement in Asymptomatic Multinodular Goiter With an Intrathoracic Component

Antonio Ríos, José Manuel Rodríguez, Pedro José Galindo, Pedro Antonio Cascales, María Balsalobre, and Pascual Parrilla

Servicio de Cirugía General y del Aparato Digestivo I, Hospital Universitario Virgen de la Arrixaca, El Palmar, Murcia, Spain

Respiratory tract obstruction is underestimated in asymptomatic intrathoracic goiter. Our aim was to evaluate the involvement of the upper airway of asymptomatic patients with intrathoracic multinodular goiter, assessing the effect on respiratory function by means of spirometry. We selected 21 patients with asymptomatic intrathoracic goiter on whom a thyroidectomy had been performed. Spirometry was done in supine decubitus and in standing position before and 3 months after surgery. The preoperative study in decubitus showed mild obstruction in 4 cases (20%). In 2 of these cases this condition was also present in standing position (10%). Spirometry became normal after surgery in the 4 patients with obstruction.

To conclude, spirometry in asymptomatic intrathoracic goiter shows mild obstruction of respiratory function in 10% to 20% of cases, depending on position. Surgery was associated with normalization of the abnormal parameters and an improvement in the remaining parameters. These data support the need to schedule surgery as soon as possible.

Key words: *Multinodular goiter. Asymptomatic. Surgery. Intrathoracic goiter. Spirometry.*

Valoración espirométrica de la afectación respiratoria en el bocio multinodular asintomático con componente intratorácico

La obstrucción de la vía aérea se infravalora en el bocio intratorácico asintomático. Nuestro objetivo ha sido valorar mediante espirometría la afectación de la vía aérea superior y la repercusión en la función respiratoria de pacientes asintomáticos con bocio multinodular intratorácico. Para ello se seleccionó prospectivamente a 21 pacientes con bocio intratorácico asintomático a quienes se había practicado una tiroidectomía. Se realizó la espirometría en decúbito supino y en bipedestación antes y a los 3 meses de la cirugía. El estudio preoperatorio mostró en decúbito una afectación obstructiva leve en 4 casos (20%), en 2 de los cuales persistía en bipedestación (10%). Tras la cirugía se normalizó la alteración en los 4 casos.

En conclusión, la espirometría en el bocio intratorácico asintomático muestra una afectación obstructiva leve de la función respiratoria en el 10-20% de los casos, en función de la postura. La cirugía se acompaña de la normalización de los parámetros alterados y de la mejoría del resto. Estos datos apoyan la necesidad de indicar la cirugía lo antes posible.

Palabras clave: *Bocio multinodular. Asintomático. Cirugía. Bocio intratorácico. Espirometría.*

Introduction

Most intrathoracic goiters are multinodular, given that a goiter will tend to develop multinodularity and functional autonomy and to occupy the retrosternal space if left to its natural course.[1] When a goiter is only cervical, it rarely compresses or obstructs the upper airway.[2,3] In goiters causing respiratory symptoms due to compression, the trachea is clearly involved.[4] However, the respiratory component has been underestimated in asymptomatic intrathoracic goiter.

Although spirometry is not the most sensitive technique for respiratory examinations, it is a widely available, useful test of lung function. By means of spirometry we can assess the effects of tracheal compression due to intrathoracic goiter quickly, easily, and economically. As studies have also found that patients with goiter have abnormal airflow dynamics,[5,6] lung function assessment may add information to that obtained with traditional radiography in the diagnosis of upper airway obstruction. Spirometry can also provide guidance in scheduling early surgery if there is cause.

The aim of this study was to assess upper airway involvement in asymptomatic patients with intrathoracic multinodular goiter, including the effect of such involvement on lung function by means of spirometry. We also observed clinical course after surgical removal of the goiter.

Correspondence: Dr A. Ríos.
Avda. de la Libertad, 208
30007 Casillas,
Murcia, Spain
E-mail ARZRIOS@teleline.es

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TABLE 1
Comparison of Spirometry Findings in Standing and Decubitus Positions Before Surgery[a]

Parameter	Standing	Decubitus	*P*
VC, L	2.7 (0.7)	2.6 (0.8)	.007[b]
FEV_1, L/s	1.8 (0.6)	1.7 (0.4)	.056
FEV_1/VC, %	68.3 (5.4)	67.1 (3.4)	.412
PEF, L/min	255.6 (84.1)	200.8 (79.6)	<.0001[b]
$FEF_{25\%-75\%}$, L	1.6 (0.8)	1.4 (0.6)	.065
$FEF_{75\%-85\%}$, L	0.3 (0.1)	0.3 (0.1)	.220

Abbreviations: $FEF_{25\%-75\%}$, forced midexpiratory flow; $FEF_{75\%-85\%}$, forced expiratory flow between 75% and 85% of vital capacity; FEV_1 forced expiratory volume in the first second; PEF, peak expiratory flow; VC, vital capacity.
[a]Data are presented as mean (SD).
[b]Statistically significant differences

Case Descriptions

Sample and Selection Criteria

Twenty-one patients with multinodular goiter were selected prospectively based on the following criteria: *a)* intrathoracic component according to the definition by Eschapasse[7] (a goiter which is totally or partially localized in the mediastinum, and which in the operative position has its inferior edge at least 3 cm below the sternal manubrium); *b)* absence of symptoms due to compression of the upper airway either in supine decubitus position or triggered by maneuvers; *c)* absence of clinical or subclinical hyperthyroidism; and *d)* absence of lung or heart disease, of smoking, and of muscle diseases so as not to include patients with a restrictive pattern who might introduce confounders. All patients underwent surgery in our hospital between 1999 and 2003.

Spirometry

Spirometry was performed before the operation and 3 months later on all patients who met the selection criteria. Both simple and forced spirometries were performed, each in both supine decubitus and standing positions, in all patients. The forced spirometry maneuver was repeated at least 3 times, until 3 satisfactory curves were obtained, never attempting more than 9 maneuvers since an exhausted patient would be unable to improve the trace. Spirometry was considered technically satisfactory when, after obtaining the 3 valid curves, the difference between the 2 best ones was less than 5% or 100 mL. Curves also had to last for at least 6 seconds. The spirometer microprocessor calculated normal values for each parameter for each individual based on patient characteristics (age, sex, height, and weight). Patients were warned not to use bronchodilator medication and not to smoke or have beverages with caffeine in the hours prior to the test. The purpose of the study was explained to each patient.

Analyzed Variables

The spirometry variables assessed were the following: *a)* vital capacity (VC), the maximum volume of air expired after maximum inspiration; *b)* forced expiratory volume in 1 second (FEV_1); *c)* FEV_1/VC (the Tiffeneau index); *d)* peak expiratory flow (PEF); *e)* forced midexpiratory flow ($FEV_{25\%-75\%}$); and *f)* forced expiratory flow between 75% and 85% of VC ($FEF_{75\%-85\%}$). Given the presence of an obstructive pattern, severity was graded based on the percentage of FEV_1 reference values. Obstruction was considered mild if FEV_1 expressed as a percentage of reference was between 70% and 65%, moderate if between 64% and 50%, severe if between 49% and 35%, and very severe if less than 35%.

Statistical Analysis

Data were analyzed with the SPSS software package, version 11.0 (SPSS Inc, Chicago, Illinois, USA). Descriptive statistics were calculated and the *t* test was applied. Results are presented as means (SD). The differences were considered significant for values of *P* less than .05.

Results

Data for 21 patients, on whom preoperative spirometry was performed both in decubitus and standing positions, were analyzed. After 3 months, spirometry was performed on 20 patients; 1 patient moved to another community.

Spirometry in decubitus position showed mild obstruction in 4 cases (20%). However, when spirometry was performed in standing position, only 2 patients (10%) continued to show signs of a respiratory component. Spirometry normalized after surgery in all 4 cases.

Spirometry Findings Before Surgery

The results of spirometry were better in standing position than in decubitus position. A higher VC of 2.7 (0.7) L was found in standing position (compared to 2.6 [0.8] L in supine decubitus; *P*=.007). PEF was also better in standing position, at 255.6 (84.138) L/min compared to 200.8 (79.6) L/min

TABLE 2
Comparison of Spirometry Findings in Standing and Decubitus Positions in Patients With Intrathoracic Multinodular Goiter Before and After Surgery[a]

Parameter	Standing Before Surgery	Standing After Surgery	*P*	Decubitus Before Surgery	Decubitus After Surgery	*P*
VC, L	2.7 (0.7)	2.6 (0.5)	.750	2.6 (0.8)	2.5 (0.5)	.437
FEV_1, L/s	1.8 (0.6)	1.8 (0.4)	.926	1.7 (0.4)	1.9 (0.6)	.013[b]
FEV_1/VC, %	68.3 (5.4)	68.0 (5.8)	.777	67.1 (3.4)	70.3 (8.9)	.133
PEF, L/min	255.6 (84.1)	258.1 (50.2)	.862	200.8 (79.6)	265.5 (68.1)	<.0001[b]
$FEF_{25\%-75\%}$, L	1.6 (0.8)	1.4 (0.6)	.001[b]	1.4 (0.6)	1.4 (0.6)	.895
$FEF_{75\%-85\%}$, L	0.3 (0.1)	0.3 (0.1)	.239	0.3 (0.1)	0.2 (0.1)	.070

Abbreviations: $FEF_{25\%-75\%}$, forced midexpiratory flow; $FEF_{75\%-85\%}$, forced expiratory flow between 75% and 85% of vital capacity; FEV_1, forced expiratory volume in 1 second; PEF, peak expiratory flow; VC, vital capacity.
[a]Data are presented as mean (SD).
[b]Statistically significant differences

in supine decubitus (*P*<.001*)*. No significant differences were observed in the remaining parameters (Table 1).

Spirometry Findings After Surgery

$FEF_{25\%-75\%}$ measured in standing position improved after surgery. The preoperative value of 1.4 (0.6) L rose to 1.6 (0.8) L (*P*=.001). The remaining parameters did not improve significantly as can be seen in Table 2.

The preoperative PEF of 200.8 (79.6) L/min in supine decubitus improved to 265.5 (68.1) L/min after surgery (*P*<.001). FEV_1 also improved, rising from 1.77 (0.4) L/s before surgery to 1.9 (0.6) L/s after surgery (*P*=.013). The remaining parameters did not improve significantly as can be seen in Table 2.

Discussion

Simple radiography of the respiratory tract is the method most commonly used for initial assessment of the upper airway in the patient with goiter. Although this technique is useful, it only detects cases with a significant respiratory component.[5] Miller et al[8] observed that ultrasound and simple radiography of the thorax are useful for predicting the retrosternal extension of the goiter but not for detecting airway obstruction. They therefore recommended the airway itself be examined, although only for patients who are symptomatic. However, it must be emphasized that the airway will be affected in nearly all symptomatic patients, while the fact of being asymptomatic will not rule out such involvement. In this sense, some authors report that the prevalence of abnormal airflow dynamics in the upper airway is relatively high.[5,6] The group of Miller et al[6] showed that 31% of patients with goiter have airway obstruction.

We found that 10% of our patients with asymptomatic intrathoracic goiter already had some degree of obstruction. This percentage increased to 20% when the examination was carried out in supine decubitus. This finding is very important for clinicians since the following has to be borne in mind: *a)* the intrathoracic goiter will tend to grow—and therefore the percentage of patients with obstruction will increase considerably, the degree of obstruction will increase gradually, and symptoms will start to appear; *b)* although we screened patients to exclude those with respiratory disease, it may be that in patients with such diseases (eg, chronic obstructive pulmonary disease or asthma), the goiter would exacerbate such underlying obstructive or restrictive diseases by adding a further obstructive component; and *c)* possibly the most important point, our findings support the early scheduling of surgery for all patients with intrathoracic goiter since improvement has been reported for even those with respiratory parameters within normal ranges.[5,6,9] Geraghty et al[9] observed clear improvement in airflow dynamics after surgical treatment of goiter. Therefore, we should avoid the surgical delays that sometimes occur in patients with anesthetic or surgical risk related to pulmonary diseases such as COPD. These patients can undergo surgery if they are asymptomatic and static imaging techniques do not show clear tracheal involvement, given that delay will only add an obstructive component to an underlying restrictive disease. If surgery is delayed until this obstructive component is moderate to serious, surgical risk and the vital risk of respiratory failure will increase significantly, especially if we bear in mind that obstruction is accentuated with change of posture.[10-12] It must be remembered that the pressure of the abdominal viscera on the diaphragm and the goiter on the trachea will cause a reduction in VC, as seen in our study.

Currently, surgery is the treatment of choice since it prevents a growing goiter from occupying the space and normalizes existing abnormalities, as shown in our study. The main limitation of surgery is the consequent morbidity. However, the most recent studies[13,14] have reported that morbidity and mortality are low in hospitals with experience in endocrine surgery.

To conclude, in patients with intrathoracic goiter and without pulmonary disease, spirometry indicates the presence of a mild obstructive component affecting respiratory function in 10% to 20% of cases, depending on posture. Abnormal parameters normalize after surgery and the remaining spirometric parameters improve. These data support the need to schedule early surgery for asymptomatic intrathoracic goiter.

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