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# Incidence and diagnosis of endoscopically-managed sinonasal tumors at the General Hospital of Mexico (Hospital General de México, OD)

**Israel Chimal Gallardo**

*Hospital General de México*

**Rogelio Chavolla Magaña**

*Hospital General de México*

**Jorge Moisés Hernández**

*Hospital General de México, OD*

**Alberto Labra**

*UNAM.*

**Ángel Daniel Huerta Delgado**

*Hospital General de México, OD*

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## Resumen

### ANTECEDENTES

Los tumores de la nariz y de los senos paranasales son una de las enfermedades que más comúnmente se observan en la práctica de la otorrinolaringología; sus consecuencias pueden tener un fuerte impacto en la vida del paciente.

### OBJETIVO

Conocer la incidencia y los síntomas más comunes de los tumores nasosinusales tratados en este servicio con endoscopia.

### PACIENTES Y MÉTODOS

Estudio retrospectivo, observacional, descriptivo y longitudinal, con serie de casos. Se incluyeron 62 pacientes valorados y tratados entre 1995 y el 2003. Después de analizar los expedientes se aplicó estadística descriptiva mediante distribución de frecuencias y medidas de tendencia central y de dispersión.

### RESULTADOS

Los síntomas más comunes fueron: obstrucción nasal, rinorrea y prurito nasal, mientras que histopatológicamente lo más frecuente fue: pólipo nasal y antrocoanal, así como papiloma nasal invertido.

### CONCLUSIONES

Los síntomas más comunes fueron la obstrucción nasal, seguida de rinorrea, lo cual se correlaciona con lo reportado en la bibliografía respecto a la enfermedad neoplásica nasosinusal.

## Abstract

### BACKGROUND

Tumors arising at the nose and paranasal sinuses are a very common condition found on the otorhinolaryngologic practice; their consequences may even impact on the patient's life.

### OBJECTIVE

To know the incidence and the most frequent symptoms of this kind of neoplasms that were treated on our department with endoscopic surgery.

### PATIENTS AND METHODS

On this retrospective, observational, descriptive and longitudinal study, 62 patients who were assessed and treated from 1995 to 2003 were included. Descriptive statistics were used with frequency distribution and central tendency and dispersion measures.

### RESULTS

The most commonly found symptoms were nasal obstruction, nasal discharge and itching, while at the histopathological examination, the most common diagnoses were nasal and antrochoanal polyps as well as inverted nasal papilloma.

### CONCLUSIONS

The most common symptoms were nasal obstruction followed by rhinorrhea. This has correlation with the literature regarding the nasosinusal neoplastic disease.

#### Palabras clave:

tumores nasosinusales, neoplasias benignas y malignas.

#### Key words:

nasosinusal tumors, benign and malignant neoplasms.

## Introduction

Endoscopic surgery of the nose and paranasal sinuses was based on surgical techniques developed at the end of the past century. This type of surgery followed the introduction of the endoscope and microscope; it represented an innovative form of intervention for chronic sinusitis.<sup>1</sup> In 1901 Hirshman performed the first sinonasal endoscopy with a modified cystoscope.<sup>2</sup> Maltz coined the term "sinuscope" in 1925 and supported this technique for diagnosis of sinus disease.<sup>3</sup> During the 1960s, Hopkins designed the current endoscope. This development allowed for sufficient optical quality and illumination to perform routine endoscopic diagnosis and treatment of sinonasal diseases. Today, sinonasal tumors are managed more and more often with these types of procedures.

Surgical support for sinonasal tumors dates back to the beginning of the 20<sup>th</sup> century, when a detailed macroscopic distinction between chronic inflammatory polyps and certain types of benign and malignant tumors had still not been established.<sup>4</sup>

In its initial stages, endoscopy was only an optical aid for differentiation and knowledge of morphological characteristics of sinonasal tumors, but it currently permits surgery of sinonasal tumors in a manner that is both correct and parallel to oncological manifestation. Advances in radiology and pathology have allowed for the classification of sinonasal tumors and for the development of endoscopic surgery techniques.<sup>5</sup> Minimally invasive endonasal surgery has the objective of complete tumor resection, in a manner similar to conventional intervention.

Endoscopic surgery of tumors of the nose and paranasal sinuses consists of correct oncological resection under direct visual control, followed by resection of histologically defined tissue specimens from the margins of the healthy tissue.<sup>6</sup> This procedure requires adequate preoperative

imaging diagnosis, histological diagnosis and a complete set of surgical instruments.<sup>7</sup> The surgeon should be familiar with the local anatomy and should have sufficient experience for performing endoscopic surgery. With surgical endoscopic treatment, external incisions are avoided. As a result, scar formation, hemorrhaging and neuralgias are also avoided, thereby reducing morbidity and mortality.<sup>8</sup> There are few possible sequelae, and for this reason, endoscopic surgery is a well-accepted method.

## Patients and methods

We examined the records of patients who had undergone endoscopic procedures of the nose and paranasal sinuses, whether for histopathological diagnosis or as treatment in this unit between 1995 and 2003. The following variables were investigated: sex, age, type of tumor, localization, size, evolution time and most common symptoms.

According to study type, descriptive statistics included frequency distribution and measurements of central tendency and dispersion. Statistical analysis, where applicable, was performed using STATS 1.1 for Windows.

The general objective of the study was to examine the incidence and most common symptoms of sinonasal tumors that were managed with endoscopic resection in the department of otorhinolaryngology and head and neck surgery between 1995 and 2003. Specific objectives were:

1. Understand the incidence of benign and malignant sinonasal tumors managed with endoscopy at the General Hospital of Mexico (Hospital General de México).
2. Learn about the most common symptoms associated with these neoplasias.
3. Identify the most frequent localization of sinonasal tumors.

In order to achieve these objectives, an observational, descriptive, longitudinal, retrospective case series study was

designed. Inclusion criteria were: a) patients surgically managed with endoscopic technique in the department of otorhinolaryngology and head and neck surgery of the General Hospital of Mexico (Hospital General de México); b) patients operated on between January 1995 and December 2003; c) patients with complete clinical record; d) patients manifesting some type of sinonasal neoplasia. Exclusion criteria were: a) patients diagnosed or managed at the departments of oncology, hematology or general surgery; b) patients who had undergone open surgical procedures; c) patients with incomplete clinical records.

## Results

A total of 101 patients manifested some type of sinonasal tumor and were surgically managed with endoscopic procedures. Only 62 clinical patient records met inclusion criteria, and these were analyzed.

### Age and gender

There were 27 male patients and 35 female patients. Age was measured in years.

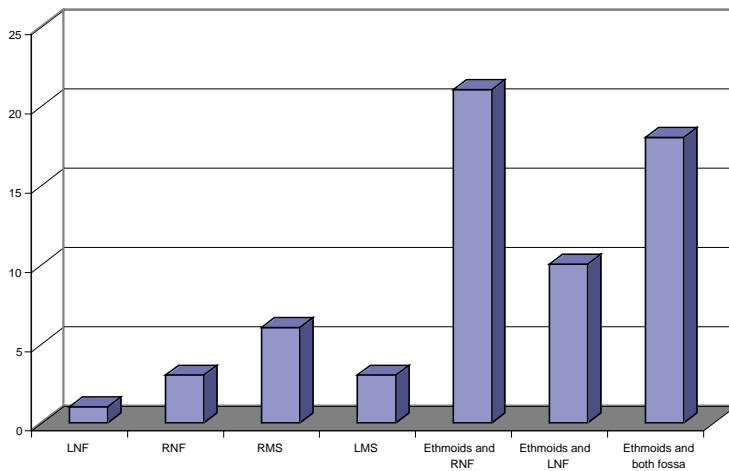
A mean of 39.87 years was obtained; with a median of 40; mode of 37 and 52; variance of 235.68; and range of 72, with minimum value of 10 and maximum of 82. Standard deviation was 15.352 and standard error was 1.95.

### Evolution time and symptoms

Measurement was recorded in months (Table 1). The mean was 68.79, the median was 48, the mode was 72, variance was 5,520.26, and range was 357, with minimum value of 3 and maximum of 360. Standard deviation was 74.298 and standard error was 9.436.

The most common symptoms were:

1. Nasal obstruction
2. Rhinorrhea
3. Nasal pruritis
4. Yawning



**Figure 1.** Most common tumor localization. LNF: left nasal fossa; RNF: right nasal fossa; RMS: right maxillary sinus; LMS: left maxillary sinus.

for which this type of study could be considered useful is that there are few reports in the worldwide literature presenting specific data for these types of tumors. The incidence of these tumors in the general population is low, and therefore few centers across the world report substantial case series. The objective of reporting the specific experience of this department of otorhinolaryngology and head and neck surgery is to collaborate in this area and participate in the creation of future studies with better methodological support and which can form part of a meta-analysis.

**Table 1.** Age distribution, by sex

Age	Female	Male
0-9	0	0
10-19	5	2
20-29	6	3
30-39	8	6
40-49	9	5
50-59	5	6
60-69	1	5
70-79	0	0
80-89	1	0
Total	35	27

**Table 2.** Most common symptoms in this patient series

Symptoms	Number of patients
Epistaxis	13
Nasal obstruction	62
Rhinorrhea	59
Sneezing	43
Facial pain	23
Volume increase	2
Halitosis	38
Nasal voice	7
Nasal pruritis	46
Hyposmia	21
Dysgeusia	6
Weight loss	4
Adenomegaly	2

- 5. Halitosis
- 6. Facial pain

The complete ratio is shown in Table 2.

**Histopathologic diagnosis**

A detailed breakdown of histopathological diagnoses can be seen in Table 3. The most common tumors were benign, including: nasal polyposis, antrochoanal and angiomatous polyposis, inverted nasal papilloma and maxillary cyst.

Only two of the diagnoses corresponded to malignant neoplasias: non-Hodgkins lymphoma and epidermoid carcinoma.

**Localization**

- Left nasal fossa: 1
- Right nasal fossa: 3
- Right maxillary sinus: 6
- Left maxillary sinus: 3
- Ethmoid and right nasal fossa: 21
- Ethmoid and left nasal fossa: 10
- Ethmoid and both nasal fossae: 18

**Discussion**

It should be taken into account that descriptive case series studies are the most basic form of research and by methodological definition are insufficient to permit conclusions. The reason

Sample size is very important. If 62 patients can represent a considerable number (taking into account the comments from the previous paragraph), it is also certain that such a small sample cannot be representative of the general population; therefore, although the study’s internal validity is acceptable, its external validity is almost null. One of the main objectives of this study is to establish the bases for the development of lines of investigation with better designed studies and with adequately calculated sample sizes, which imply statistical significance. The

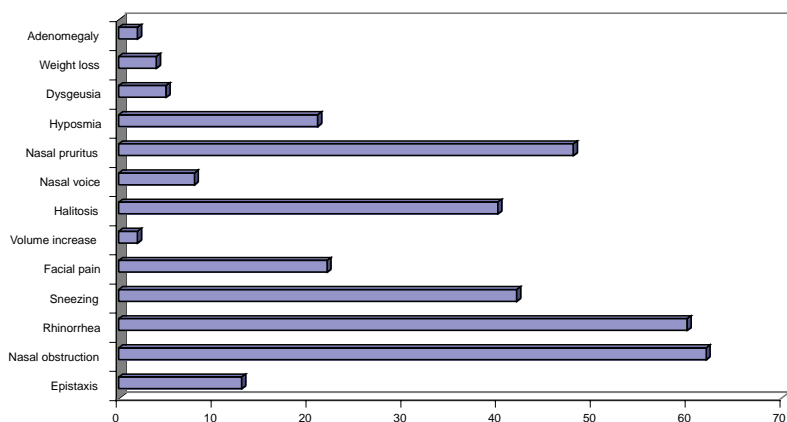


Figure 2. Most-often detected symptoms.

**Table 3. Histopathological diagnoses**

Diagnosis	Female	Male	Total
Polyposis	25	13	38
Antrochoanal polyp	2	3	5
Maxillary cyst	1	3	4
Non-Hodgkin's lymphoma	1	2	3
Inverted papilloma	2	3	5
Fibroepithelial polyp	0	1	1
Nasal carcinoma	2	2	4
Angiomatous polyp	1	0	1
Nasopharyngeal carcinoma	1	0	1
Total	35	27	62

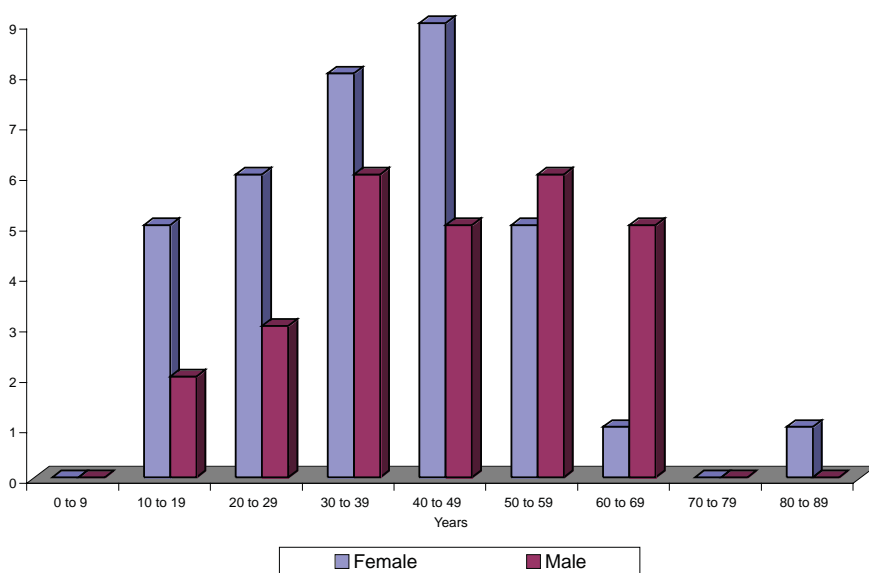


Figure 3. Distribution by age and sex.

study displays data not easily obtained in the worldwide literature, and which is indispensable for calculating sample size, as well as standard deviation and means.

Among histopathologic diagnoses there were benign and malignant neoplasias (predominantly benign). The most frequent diagnosis was sinonasal polyposis (38 cases), predominantly among females (25 patients), followed by antrochoanal polyps (5 cases) and maxillary sinus cysts (4 cases). Detected malignant neoplasms, by order of frequency, were: nasal cancer (4 cases), non-Hodgkins lymphoma (3 cases) and nasopharyngeal cancer (1 case). In the majority of the patients, these illnesses were associated with consumptive symptoms (adenomegaly and weight loss); the gender ratio was 1:1.

Other less frequent diagnoses were: fibroepithelial and angiomatous polyp and inverted nasal papilloma.

Average age of manifestation for both sexes was 39.87 years, with a range of 72 years. Minimum and maximum ages were 10 and 82 years, which corresponded to the feminine sex.

Average evolution time, in months, was 68.79, with range of 357 months, which reflects the great variability in the duration of symptoms up to the moment of specialized treatment. Benign neoplasias (nasal polyposis) had the longest time of evolution (360 months), while malignant neoplasias had the shortest evolution time (three months).

The most common symptom in this study was nasal obstruction in 62 patients, followed by rhinorrhea (59 patients), which correlates with the bibliography with respect to sinonasal neoplastic disease. Other important symptoms reported by patients were: sneezing (43 cases), nasal pruritus (46 cases) and halitosis (38 cases). It is important to mention that this last symptom was found to be associated with sinonasal polyposis in the majority of the cases.

The most commonly affected site was the ethmoid sinus and one or both nasal fossae; this was always related to sinonasal polyposis. In general, in the rest of the neoplasias one of the nasal fossae was affected, as well as the maxillary sinus ipsilateral to these. No patient had extension to the orbit, cranial fossa or palate.

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# Cosmetic results of Weir surgery using radiofrequency vs conventional scalpel at the Clínica de Cirugía Facial y Cosmetología de la ciudad de Puebla

Fernando Juan Ramírez Oropeza

Clínica de Cirugía Facial y Cosmetología, Puebla, Puebla, México

Alejandra del Carmen Bañuelos Arias

Estado de México

## Resumen

### ANTECEDENTES

La cirugía de la base nasal (cirugía de Weir) requiere reseca una cuña de piel vestibular de la unión ala-mejilla. Constituye una etapa externa de la rinoseptoplastia, la cual deja una cicatriz discreta; sin embargo, en ocasiones produce cicatrices deformantes. Los adelantos de la tecnología han permitido introducir la radiocirugía en el campo de la cirugía facial, con resultados alentadores.

### OBJETIVO

Comparar el resultado cosmético obtenido con radiofrecuencia vs bisturí convencional en la cirugía de Weir.

### PACIENTES Y MÉTODO

Estudio cuasiexperimental que incluyó 75 pacientes a quienes se realizó rinoseptoplastia y cirugía de Weir. Se utilizaron ambas técnicas quirúrgicas (radiofrecuencia y bisturí convencional), por lo que el mismo paciente fue su propio control.

### RESULTADOS

Se evaluaron 75 pacientes; 77% correspondieron al género femenino. La edad media fue de 26 años (DE  $\pm 12$ ). La radiofrecuencia acortó el tiempo quirúrgico y el sangrado en comparación con el bisturí ( $p < 0.0005$ ). El 50% de las heridas realizadas con bisturí ameritaron la colocación de puntos de sutura extra para controlar el sangrado. La cicatriz producida por radiofrecuencia alcanzó un buen apareamiento de color con la del lado opuesto a las cuatro semanas en 45% de los casos y con la piel circunvecina a los cinco meses en 100% de éstos. La cicatrización de las heridas realizadas con radiofrecuencia fue más lenta ( $p < 0.001$ ). El 81 y 77% de las heridas realizadas con bisturí y radiofrecuencia, respectivamente, ( $p > 0.05$ ) cicatrizaron de forma satisfactoria.

### CONCLUSIONES

La cicatrización producida con ambas técnicas no mostró diferencia significativa; sin embargo, las ventajas al utilizar radiofrecuencia hacen de esta última una mejor opción en los pacientes que requieren corrección de la base nasal ancha.

## Abstract

### BACKGROUND

Nasal base surgery requires the resection of a vestibular skin wedge of the wing-cheek union. It constitutes an external stage of rhinoplasty that will leave a scar, which in most of the cases is discreet; nevertheless, sometimes it produces deformed scars. The advancement of technology has led to the introduction of radiosurgery in the field of facial surgery, with encouraging results.

### OBJECTIVE

To compare the cosmetic results obtained with radiofrequency versus conventional bistoury in the surgery of Weir.

### PATIENTS AND METHOD

In a quasiexperimental study we included 75 candidates for rhinoplasty that required Weir's surgery. In each one of them we used both surgical procedures (radiofrequency and conventional bistoury), so the patient was its own control.

### RESULTS

We evaluated 75 patients, from which 77% were female, with age average of 26 years old (SD 12). Radiofrequency shorten the surgical time and bleeding in comparison with the conventional bistoury ( $p < 0.0005$ ). 50% of the wounds made with bistoury required the positioning of extra stitches for controlling the bleeding. The scar produced by radiofrequency reached a good mating of color with one of the opposite sides at four weeks in 45% of the cases and with the surrounding skin at five months in the 100% of the cases. The healing of the wounds made with radiofrequency was slower ( $p < 0.001$ ). 81 and 77% of the wounds made with bistoury and radiofrequency, respectively, ( $p > 0.05$ ) healed in a satisfactory form.

### CONCLUSIONS

The healing produced with both techniques did not show significant difference; nevertheless, the advantages when using radiofrequency make of this latter better option in those candidates for the correction of a wide nasal base.

#### Palabras clave:

cirugía de la base nasal, alotomías, cirugía de Weir.

#### Key words:

surgery of the nasal base, alotomy, Weir.

## Introduction

Rhinoplasty is the most commonly performed procedure in facial plastic surgery, and also the most complex procedure, based on its great variability. The objective of this procedure is to obtain a nose with adequate functioning, that is aesthetically pleasing, and that has a natural appearance which is satisfactory for the patient and the surgeon. The secret to obtaining consistent and satisfactory results is to have a clear concept of nasal and facial aesthetics, familiarity with all anatomical details, an ability to predict the changes obtained after modification of each nasal subsite and, finally, to perform the operation in a safe manner and with maximum precision.

Each racial group has marked differences in facial aspects, which are the results of the architecture of the skeletal support, of muscular insertions, of color and of skin qualities. The influence of the popular communication media has led to the idealization of the Caucasian nose; this has led patients with mestizo or negroid characteristics to seek surgical procedures that will make their features more similar to those associated with the Caucasian nose.<sup>1,2,3</sup>

Each patient has a different nose, and for this reason it is indispensable to adapt technique according to facial characteristics and personality.

In Mexico, the predominant nose type pertains to the mestizo classification, which possesses, among many other characteristics, a wide alar base, which frequently is cited as the cause for surgical adjustment during rhinoplasty.<sup>1,2</sup>

Surgery of the nasal base (Weir surgery) requires an understanding of its formative components and of the anatomical and dynamic relationship of these elements with respect to the rest of the nose and facial structures.

## Relevant anatomy of the nasal base

The nasal base, also known as the alar-columellar complex, is composed of four basic elements: nostrils, ala, columella and lobe.<sup>3-6</sup>

Daniel and Farkas identified seven different structures within the nasal base: soft triangle, lateral wall, alar threshold, nostril threshold, columellar base, columellar pillar and infratip lobule.<sup>7</sup>

The lower lateral cartilage forms the limits of the nasal base;<sup>3-6</sup> each cartilage consists of three portions: internal, medial and lateral crura.<sup>5,6,7,8</sup> The ala of the nose is formed by an anterior portion sustained by the lateral crura, and another posterior portion that corresponds to the base of the ala of the nose and which does not have cartilage. The skin of the nasal

ala is characterized by its thickness and for having numerous sebaceous glands and large pores; it is closely linked to the underlying musculocartilaginous structures and has limited elasticity and mobility (figure 1).<sup>5,6,8,9</sup> The shape and size of the medial crura contributes to the formation of the columella.<sup>8,9</sup>

In 1954 Cottle classified the racial variation in the shape of the nasal base through the nasal tip test (figure 2).<sup>10</sup>

## Analysis of the nasal base

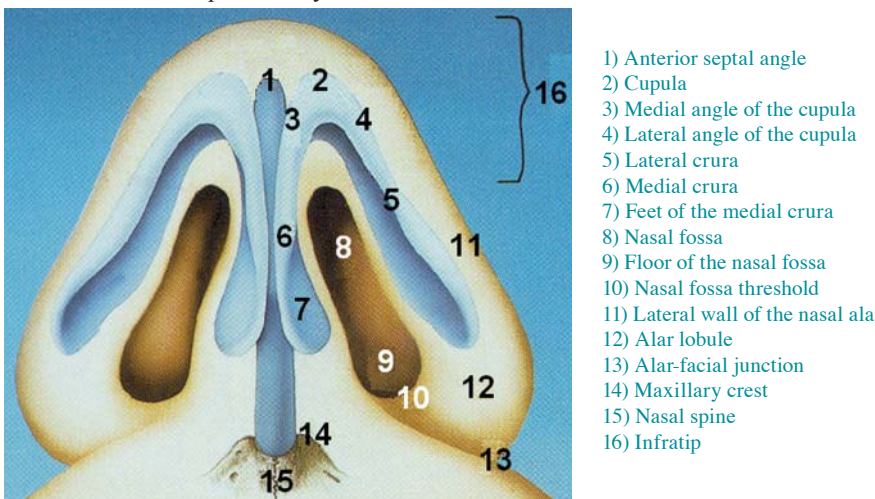
Seen from below, the nasal base has the shape of an isosceles triangle and the lobe-columella ratio should be 2:1.<sup>6,11,12</sup>

Seen from the front, it is ideal that the width of the nasal base does not surpass the intercanthal line; in this same view the columella and the border of the nostrils should resemble a “seagull in flight.” From a lateral view, the columella should not project more than 2 to 4 mm from the columellar base and the alar margins should have a soft shape resembling an “S”. There is often a double breakage of the nasolabial angle in the defined site of the nasion, formed by the columella and the infratip lobule (figure 3).<sup>3-5,11,12</sup>

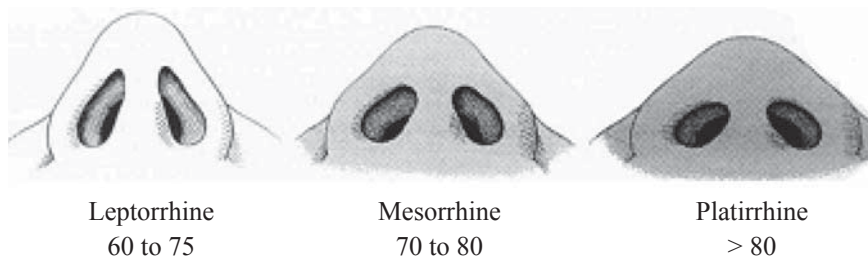
## Specific background

The adjustments to be made in the nasal ala represent the final operational period. Various techniques have been described to manage the nasal base, the majority of them focused on reducing the alar ridges, reducing a wide nasal orifice or modifying a combination of the two problems, which provides a more harmonious aesthetic result with respect to the rest of the nose. This procedure requires the resection of vestibular skin of the alar-cheek junction.<sup>3,6,13</sup>

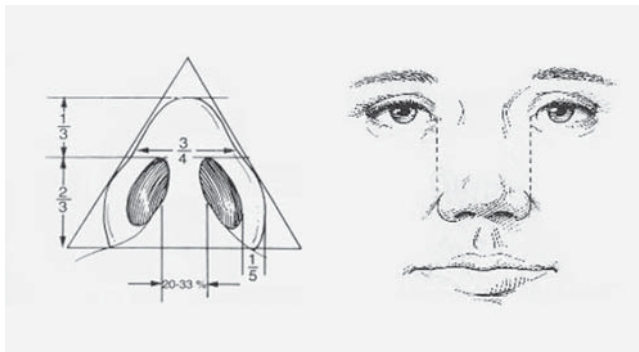
Likewise, this is an external approach which will leave a scar, which should be explained to the patient beforehand. In the majority of cases, that scar is very



**Figure 1.** Anatomical structure of the nasal base. Courtesy of: Tardy E. *Rhinoplasty the art and the science*. Philadelphia: WB Saunders, 1997.



**Figure 2.** Classification of racial variations in nasal base. Courtesy of: Mayo Foundation.



**Figure 3.** Aesthetic analysis of the nasal base. Courtesy of: Mayo Foundation.

discrete, given that it is located in the nasogenial fold; however, on occasions, deforming scars are produced.<sup>5</sup>

Technological progress has led to the introduction and development of radiosurgery in the field of facial surgery, which, presently, is a routine practice.<sup>14</sup>

Radiosurgery is a flow of high frequency electrons (4 MHz) which is propagated in the tissue through the point of the electrode and makes contact with the cellular water. The impedance of the tissue disintegrates the membrane, without destroying the surrounding tissue.<sup>15</sup> There are five methods of use: a fully filtered and rectified flow (pure cut current), fully rectified flow (blended flow cut and coagulation), partially rectified flow (coagulation and hemostasis), electrofulguration and bipolar.

In the field of plastic surgery, this can be used in distinct stages of the operation: skin incision, fine dissection and coagulation. Its use reduces the risk of infection by producing a sterile incision, optimizing surgical time,

providing clear cuts by not requiring any pressure on the skin, providing hemostasis, and by not causing postoperative edema.<sup>14-17</sup>

Peterson reported similar aesthetic results and, in some cases, better results after using electro-surgery compared to the use of a conventional scalpel in maxillofacial cosmetic operations.<sup>18</sup>

In the other study, adequate scarring was observed postoperatively in patients treated for blepharoplasty with radiofrequency.<sup>17</sup>

This study seeks to compare the aesthetic results obtained after using radiofrequency and a conventional scalpel during surgery to modify the nasal base.

## Patients and method

### Patients

A quasiexperimental study included 75 patients who had undergone rhinoplasty and merited Weir surgery in the Clinic of Facial Surgery and Cosmetology of the City of Puebla, between March and July of 2004.

### Procedures

All patients underwent complete clinical history, in which basic epidemiological data; personal and pathological history; and relevant findings from the physical examination were compiled. In order to evaluate the general state of the patients, preoperative examinations were solicited.

Photographs were taken in half letter size projections, with front, nasal base, three quarter, left and right, and left and right profile views, to perform facial analysis. The nasal base was considered to be wide when its transversal diameter surpassed the intercanthal lines.

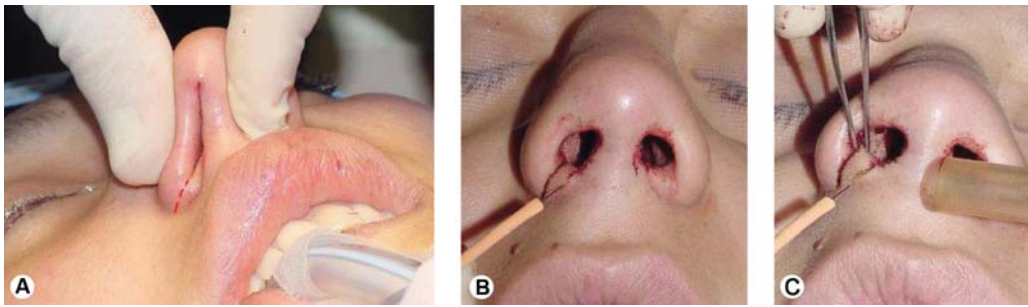
All surgical procedures were performed with balanced general anesthesia and infiltration with xylocaine + epinephrine (1:100,000). The quantity of anesthesia used in each nasal ala was 1cc in all cases. With the exception of osteotomies, Weir surgery was performed in all cases as the final step of the rhinoplasty.

Surgical techniques were used in each patient to reduce the influence of host factors in the scarring process; each patient was his own control.

In all cases, the author's personal technique in Weir surgery was used (figure 4).<sup>13</sup> A no. 15 scalpel blade was used for the left alotomy and fully rectified flow radiofrequency for cutting and cauterization (Ellman Surgitron FFPF Internacional Inc.), with colored point for the right ala (figures 5 and 6).

Once the skin cradle was resected, the wounds were closed, without tension, with two simple stitches, with nylon 5 (0), and a simple stitch in the vestibular skin, with simple catgut 4 (0). At the termination of surgery, surgical time, findings, and complications were registered. Suture points were removed slowly at 5 and 12 days. Five months after the procedure, the author clinically verified the aspect of the scarring and determined if this was acceptable or not upon evaluation of the following



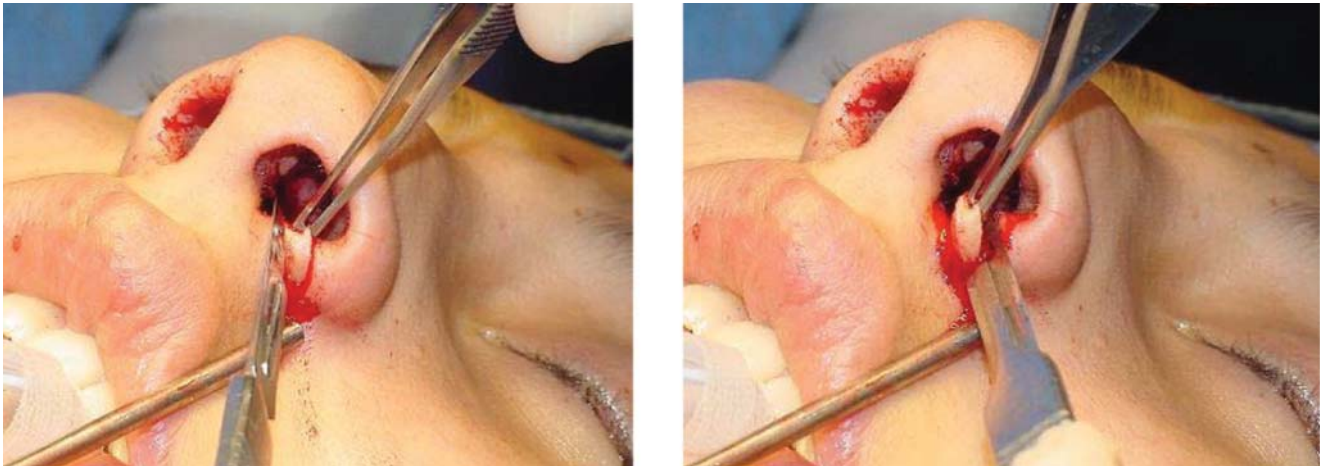


**Figure 4.** Personal technique of author in Weir surgery to estimate the quantity of skin for resection.

a. Compression of the nasal ala in the septum forms the fold in which the most lateral cut will be made in the nasal base.

b. The second cut is made in medial direction in the vestibular skin. The size of the skin wedge to be resected will vary from patient to patient.

c. Resection of a wedge of vestibular skin narrows the nasal base and respects the natural curvature of the nasal ala.



**Figure 5.** Resection of vestibular skin wedge with scalpel. Comparison of bleeding produced with scalpel and bleeding from radiofrequency.



**Figure 6.** Resection of skin wedge by radiofrequency. The absence of bleeding with radiofrequency allows a correct visualization of structures.

characteristics: 1) correct location in the melonasal fold, 2) adequate balance with the color of the adjacent tissue, 3) narrowness, and 4) location in the same plane as the adjacent tissue. Adequate scarring was considered to be a scar met three or all of the described characteristics; scars that had two or

fewer characteristics were characterized as unsatisfactory.

#### Sample size

Sample size was calculated using the two-group comparison of proportions formula. Standard value was the average of patients with satisfactory scarring

(obtained from a retrospective pilot study in postoperative Weir surgery patients in 2003 at the Clínica de Cirugía Facial y Cosmetología, Puebla, Mexico), which resulted in 70%. A 10% improvement was predicted, in relation to the earlier percentage. A potency of 80, an alpha of 0.05 and a beta of 0.20 were used.

## Statistical analysis

Descriptive statistics were used for measurements of central tendency and dispersion. To establish differences in cosmetic aspect of the scars produced with both techniques, and to establish time of closure, chi squared was used. The student t test was used for independent samples, to establish differences in surgical time in both procedures.

## Results

From March to July of 2005, at the Clínica de Cirugía Facial y Cosmetología, Puebla, 110 rhinoplasties were performed, of which 68% merited Weir surgery.

Seventy-five patients were included, of whom 58 (77%) were females. The mean age was 26 years (SD 12).

The use of radiofrequency was associated with a shorter surgical time (mean 2'60", SD 24", range 2'15" to 3'30") than the operation with scalpel (mean 3'30", SD 21", range 3' to 4') ( $p < 0.0005$ ).

Transoperative bleeding was greater with scalpel incision, which in 2.5% of the cases ( $n = 2$ ) complicated the performance of a clear cut and an adequate treatment of the borders; this merited regularization of the borders and reapplication of sutures. Likewise, in 50% of the cases, the scalpel-produced wounds required placement of 1 or 2 extra stitches to control bleeding.

The borders of the scalpel-produced wounds were clearer than the radiofrequency-produced borders.

The scar produced by radiofrequency showed better hyperemia during the first and second weeks of follow-up; a favorable color balance was achieved in relation to the opposite side at four weeks in 45% of the cases and with the adjacent skin at five months (figure 7).

The scarring of the wounds produced by radiofrequency was slower than in those from a scalpel. During the first week, 90% of the scalpel-produced



**Figure 7.** Comparison of scarring in a patient at 12 days and 5 months postoperative.

wounds were closed, in comparison with 60% from radiofrequency ( $p < 0.001$ ). There was a partial dehiscence of the radiofrequency wound, which scarred on second intention without complications. There was no other type of complication.

Sixty-one scalpel-produced wounds (81%) had satisfactory scarring compared with 58 (77%) by radiofrequency ( $p > 0.05$ ); there was no statistical significance (figure 8).

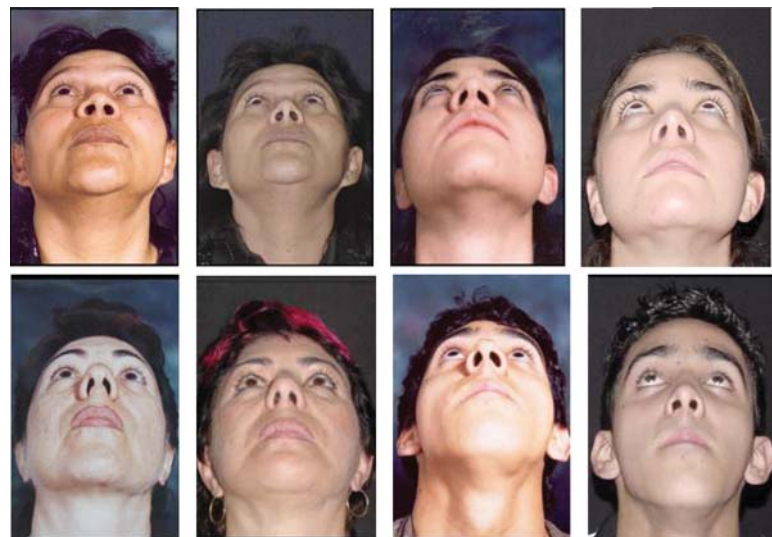
## Discussion

Modification of the wide nasal base is a challenge for the facial surgeon, because it is a critical element for achieving satisfactory results in noses with mestizo characteristics. It is a procedure that causes a scar, which in the majority of cases is acceptable.

In this study, the percentage of rhinoplasties that required management to modify a wide nasal base was 68%, which is attributable to the fact that the mestizo nose is the predominant nose type observed in our practice.

The percentage of patients in whom satisfactory scarring was achieved was greater in those whose surgical wounds were produced by a scalpel, a result explained by a clearer cut in comparison with radiofrequency, which causes thermal injury in the tissue. This injury also interferes with scarring time; it is necessary that stitches be removed slowly to avoid risk of dehiscences. Complete removal is recommended at 12 days postoperative, a time period in which 100% of the scars in the cases reported in this study were well closed.

The advantages reported in association with radiofrequency include: a sterile



**Figure 8.** Final cosmetic result in four patients. Images are shown for preoperative stage and at five months postoperative.

incision, less pressure during incisions, reduced surgical time and absence of bleeding, all of which simplify the process and facilitate adequate closure of the borders, which is indispensable for a satisfactory cosmetic result.

In spite of not finding differences in final cosmetic result, which is in accordance with the reports appearing in the bibliography,<sup>15,17,18</sup> the advantages mentioned with radiofrequency make this an attractive option for patients who require modification of the alar base of the nose.

## Conclusions

No significant differences were found in the cosmetic results of the scars after utilization of radiofrequency and scalpel. However, the advantages reported with the use of radiofrequency, such as: a sterile incision, less pressure during incisions, reduced surgical time and absence of bleeding, make this a better option for patients who need modification of a wide nasal base.

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# Frequency of tumors of the nose and paranasal sinuses in patients at the department of otorhinolaryngology of the Hospital de Especialidades del Centro Médico Nacional Manuel Ávila Camacho

Nestor Resendiz González

Centro Médico Nacional Manuel Ávila Camacho, Instituto Mexicano del Seguro Social, Puebla, Puebla, Mexico

## Resumen

### ANTECEDENTES

Los tumores de la cavidad nasal y de los senos paranasales son padecimientos fácilmente identificables que pueden encontrarse en una exploración de rutina; incluso, varios de ellos son hallazgos fortuitos.

### OBJETIVO

Identificar los grupos de edad y tumoraciones más frecuentes en la nariz y los senos paranasales en nuestros pacientes.

### PARTICIPANTES Y MÉTODO

Se revisaron los expedientes de los servicios de otorrinolaringología y patología de enero de 1993 a diciembre de 1997 para confirmar el origen de las tumoraciones.

### RESULTADOS

Se encontraron 124 pacientes con tumoraciones, 89 benignas y 35 malignas. Las benignas más frecuentes fueron los pólipos inflamatorios y las malignas los linfomas. Los tumores benignos preponderaron entre la tercera y sexta décadas de la vida y los malignos solo en la sexta. No se halló diferencia significativa en cuanto al predominio del sexo en ambos tipos de tumoraciones. Se encontró que en México existe mayor incidencia de nasofibrofibroma que en otros países. En este estudio el grupo de edad con mayor incidencia de tumoraciones de la nariz y los senos paranasales fue el de 40 a 59 años.

#### Palabras clave:

nariz, senos paranasales, tumoración.

## Abstract

### BACKGROUND

Nose and paranasal sinuses tumors are diseases easily identifiable that may be found in a routine exploration and some of them are fortuitous findings.

### OBJECTIVE

To identify that kind of tumors and groups of age most common localized in nose and paranasal sinuses.

### PARTICIPANTS AND METHODS

Ear, nose and throat pathology files were reviewed from January 1993 to December 1997, in order to corroborate each patient tumor origin.

### RESULTS

A hundred twenty-four patient tumors were detected, 89 benign tumors, 35 malignant tumors. Inflammatory polyps were the benign tumors most common identified, while lymphoma was the most malignant tumor often described. Benign tumors were predominantly found in patients from the third to sixth living decade. Malignant tumors were principally found on the sixth living decade. Significant differences were not found about gender prevalence in both kinds of tumors. There is a major incidence of juvenile nasopharyngeal angiofibroma cases in our country than in foreign populations. In this study the group of age most affected by nasal and paranasal sinuses tumors was from age 40 to 59.

#### Key words:

nose, paranasal sinuses, tumors.

## Introduction

For several centuries, the medical literature has included references to tumors of the nasal cavity and of the paranasal sinuses. These are easily identifiable clinical illnesses which can be detected during routine exploration; some of these detections are actually

fortuitous occurrences, given that the patient did not have symptoms at the moment of diagnosis.<sup>1</sup>

In the international medical literature, the reported incidence of nasal tumors depends on variables such as occupation, social status, and genetic factors.<sup>1-3</sup>

Among agents of origin, both job-related and non-job-related factors are reported, as well as agents related to human papillomavirus.<sup>3,4</sup>

A multitude of classifications were proposed for tumors of the nose and paranasal sinuses, the majority of them in their histological aspect, that is: benign,

malignant or histologically benign but with malignant behavior.<sup>5-7</sup>

Carcinomas of the nose and paranasal sinuses have biological behavior and variable prognosis, and can reach a substantial size before manifesting signs and symptoms.<sup>8</sup> Malignant tumors of the nose and paranasal sinuses are predominant in male patients by a 2:1 ratio.<sup>9</sup> Among all cancers, cancers of the nose and paranasal sinuses represent about 0.2%, and cancers of the upper region of the respiratory and digestive tracts represent 3%.<sup>10</sup>

Traditionally, paranasal sinus carcinoma is associated with a severe prognosis.

In Mexico there are few reports based on studies of tumors of the nose and paranasal sinuses.

Our hospital lacks previous statistics relating to these conditions and, given that their symptoms are compatible with those of other nasal illnesses and their diagnosis is frequently late, we decided to investigate the frequency of tumors originating in the nose and paranasal sinuses in our field.

## Patients and methods

This study was undertaken in the departments of pathology and otorhinolaryngology, where patient notebooks and records were reviewed for the period between January 1993 and December 1997 to confirm the origin of the detected tumors of the nose and paranasal sinuses. Patients of all ages and both sexes were included. Incomplete reports were excluded, as well as those of patients whose tumors did not originate in the nose and paranasal sinuses.

## Results

A total of 124 patients had tumors, with an age range from 8 to 44 years and an average of 40.23 years; 54.8% (68) were men and 45.1% (56) were women. Distribution by age group is shown in Table 1.

**Table 1.** Distribution of tumors by age group

<i>Years</i>	<i>0-19</i>	<i>20-39</i>	<i>40-59</i>	<i>60 or more</i>
No. of patients	17	39	49	14
Percentage	13.7	31.45	39.51	15.32

**Table 2.** Benign tumors

<i>Type</i>	<i>Number</i>
Inflammatory polyp	40
Antrochoanal polyp	6
Hemangioma	9
Nasal angiofibroma	15
Papilloma	8
Fibroma	5
Glomus tumor	1
Odontogenic cysts	3
Adenoma	1
Neurofibroma	1
Total	89

**Table 3.** Malignant tumors

<i>Type</i>	<i>Number</i>
Lymphoma	20
Epidermoid carcinoma	5
Undifferentiated carcinoma	4
Angiosarcoma	1
Adenocarcinoma	1
Cystic adenoid carcinoma	1
Neuroendocrine carcinoma	1
Embryonic rhabdomyosarcoma	1
Esthesioneuroblastoma	1
Total	35

Benign tumors were found in 89 patients (71.77%) (Table 2), of which 39 were women (43.82%) and 50 were men (56.17%). Age range in this group was from 8 to 75 years with an average of 36.97 years. The most frequent illnesses were: inflammatory polyps (44.94%), nasal angiofibroma (16.85%), nasal hemangioma (10.11%) and papilloma (8.98%).

Malignant tumors were found in 35 patients (28.22%) (Table 3); 17 were

women (48.57%) and 18 were men (51.42%). In this group the age range was from 17 to 84 years, with an average of 48.51 years. The most frequent illnesses were: lymphoma (57.14%), epidermoid carcinoma (14.2%) and undifferentiated carcinomas (11.42%).

## Discussion

There are a wide variety of benign and malignant tumors. Benign tumors are found with a frequency similar to

that reported in the national medical literature.<sup>10,11</sup>

The following factors were causative agents: alcoholism, smoking, and workplace contact with some chemical agents, wood and nickel. In some studies in countries such as France and England, a significant and direct relationship was found between these risk factors and nasal tumors.<sup>1-3</sup>

In our country, there are no such previous studies; reports are limited to the incidence of the mentioned illnesses.

Also, it was related with human papillomavirus, specifically types 6b and 11, and was proved with DNA sequences which had a significant role of origin.<sup>4</sup> Unfortunately, in our field, it has not been possible to corroborate this implication, probably because of a lack of adequate safety controls necessary for these studies.

It is also important to consider the relationship between allergy and inflammatory polyps, given that this condition is the most frequent of the benign tumors. According to the findings from this study, the data are similar to those reported in the foreign and national literature.

In this project, a high incidence of nasal angiofibroma was noted in the benign tumors, which is similar to the information from previous reports from the national literature, but contrasts to a great extent with the tumor frequencies reported in the international literature. In our study there is no significant difference with respect to the sex of patients with nasal tumors, with the exception of nasal angiofibroma, which characteristically manifests in adolescent males; this also coincides with international and national reports. Patients with this illness were included in the benign tumor group in spite of the fact that there are studies that, despite

classifying these tumors as benign, have detected malignant behavior. In this study, they are considered benign given that, histologically, they do not have atypia nor dysplastic or metaplastic processes characteristic of a malignant neoplasia.

The patients with benign tumors were younger than those with malignant tumors.

There was a high incidence of benign tumors between the third and sixth life decades; these data are similar to reports from the national and foreign literature.<sup>2,10</sup> In patients with malignant tumors, there was a higher incidence in the sixth life decade, which is similar to findings from other studies and corroborates the relationship that exists between age and severe prognosis.

It is important to note that the majority of foreign studies and reports point to epidermoid carcinoma as the most frequent malignant tumor. Our study has the same finding and coincides with previous reports from the national literature.<sup>10,11</sup>

Given the variability of the clinical stages of the different illnesses, it was not possible to determine which location had the worst prognosis. However, the international medical literature has pointed to paranasal sinus carcinoma as having the worst prognosis.<sup>12</sup>

For the previously mentioned reasons, we consider it important to be aware of the most frequent illnesses in these areas in order to establish the most adequate study protocol and improve the quality of care for our patients.

#### Acknowledgments

We appreciate the support provided for this study by Dr. Jorge Álvarez Balbas, chief of the department of otorhinolaryngology of the Hospital de Especialidades del Centro Médico Nacional Manuel Ávila Camacho del IMSS de Puebla, Puebla.

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# Impact of endoscopic intervention within medical institutions

**José R. Arrieta Gómez**

*Hospital General Dr. Manuel Gea González. UNAM*

**Sergio Iván González Olvera**

*Hospital General Dr. Manuel Gea González, Universidad La Salle. UNAM*

**Héctor Manuel Prado Calleros**

*Hospital General Dr. Manuel Gea González. UNAM. IPN*

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## Resumen

### OBJETIVO

Conocer los datos relacionados con la intervención endoscópica de la nariz y los senos paranasales en diversas instituciones de la República Mexicana donde existen programas de residencias de otorrinolaringología.

### MATERIAL Y MÉTODOS

Se hicieron llamadas telefónicas para contactar en la mayor parte de las sedes a los jefes de servicio o, en su ausencia, a un médico adscrito. Sólo en una sede se encontró a un médico residente.

### RESULTADOS

La mayor parte de las instituciones cuenta, cuando menos, con un equipo de endoscopia diagnóstica. El 90% de los hospitales tiene entre uno y tres equipos e instrumental para intervención endoscópica. Únicamente dos instituciones cuentan con neuronavegador quirúrgico. La intervención endoscópica de la nariz y los senos paranasales se practica entre 34 y 100%. Solamente en dos de las 24 instituciones operan el 100% de las enfermedades rinosinuales con intervención tradicional. Cuatro de las instituciones hacen talleres anuales de intervención endoscópica de la nariz y los senos paranasales.

### CONCLUSIONES

La mayor parte de las instituciones de enseñanza de la otorrinolaringología mexicana tiene equipos para diagnóstico y para intervención endoscópica de la nariz y los senos paranasales.

## Abstract

### OBJECTIVE

To present a series of data relating to endoscopic intervention of the nose and paranasal sinuses at institutions with residency programs in otorhinolaryngology in the Republic of Mexico.

### MATERIAL AND METHODS

The department heads, or in their absence, an adjunct physician, at the majority of these institutions were contacted by telephone. A resident physician was contacted at only one of these sites.

### RESULTS

The majority of these institutions have at least one diagnostic endoscopy equipment set. Ninety percent of the hospitals have between one and three equipment sets and instrumentation for endoscopic intervention. Only two institutions have surgical neuronavigators. Endoscopic intervention of the nose and paranasal sinuses is practiced in 34% to 100% of cases. In only two of these 24 institutions, 100% of these rhinosinusal illnesses are operated with traditional interventions. Four of these institutions offer annual workshops on endoscopic intervention of the nose and paranasal sinuses.

### CONCLUSIONS

The majority of Mexican otorhinolaryngology teaching institutions have equipment for diagnosis and for performance of endoscopic intervention of the nose and paranasal sinuses

#### Palabras clave:

*cirugía endoscópica, residencias de otorrinolaringología.*

#### Key words:

*endoscopic surgery, otorhinolaryngology residencies.*

## Introduction

During the seventies, Wigand began to perform endoscopic interventions of the nose and paranasal sinuses in Europe with his posteroanterior technique, and Messenklinger did so with anteroposterior technique. Institutionally, in the Republic of Mexico, Dr. Arrieta began performing this procedure during the nineties at the Hospital General Dr. Manuel Gea González, as did Dr. Novelo at the Hospital Central Militar.

After 15 years, this endoscopic intervention has gained acceptance and, in many cases is practiced by otorhinolaryngologists in our country.

In its earliest stages in Mexico, this technique was not well accepted; there were even detractors who predicted that it had no future.

## Disadvantages

The instruments and equipment are expensive, existence of monocular vision, one hand is occupied, bleeding impedes clear vision, training is required through tutorials and workshops for skill development, there is limited availability of cadavers and these are difficult to acquire, complications are worse than those associated with traditional surgical intervention and in the medical literature it is reported that there has been an increase in complications related to this intervention.

## Advantages

With rigid endoscopy, the procedure has angles ranging from zero to 170 degrees, which allows the surgeon to approach the maxillary and frontal sinuses endonasally in practically all illnesses. In teaching exploration and surgical intervention, it is a very valuable instrument for showing the illness in the outpatient setting and during surgical procedures.

Some of the disadvantages of endoscopic interventions have been rectified, such as:

The problem of monocular vision can be resolved using a monitor and by using both eyes.

An assistant substitutes for the occupied hand and can sustain the endoscope, vacuum or use both hands to irrigate.

If the patient is hypertensive, bleeding is reduced by controlling arterial hypertension several days before the procedure. If the patient takes anticoagulants, these should be suspended at least a few weeks beforehand; if there are no contraindications, a vasoconstrictor xylometazoline between 15 and 30 minutes before beginning the intervention. The Endoscrub with constant irrigation maintains the point of the endoscope free of blood and secretions.

The third dimension is one of the problems still needing resolution, and its use is being researched.

## Objective

To present a series of data relating to endoscopic intervention of the nose and paranasal sinuses at institutions with residency programs in otorhinolaryngology in the Republic of Mexico.

## Material and methods

The department heads, or in their absence, an adjunct physician, at the majority of these institutions were contacted by telephone. A resident physician was contacted at only one of these sites.

### Data solicited:

Total number of offices (# consul). (# offices)

Number of equipment sets for diagnostic endoscopy (end dx). (diagn. endosc.)

Number of apparatus and instrumentation for endoscopic intervention (# equipos). (# equip. sets)

Total graduate otorhinolaryngologists (# médicos). (# physicians)

Number of otorhinolaryngologists who perform endoscopic intervention (med IE). (phys. EI)

Number of annual courses in endoscopic intervention of the paranasal sinuses (cursos). (courses)

If surgical navigation is available or not (navegador). (navigator)

Percentage of interventions of the paranasal sinuses of the total of otorhinolaryngological operations (CSPN). (SPNS)

Percentage of traditional interventions of the paranasal sinuses (TRAD). (TRAD)

Percentage of endoscopic intervention of the nose and paranasal sinuses (CESPN). (ESPSN)

If endoscopic intervention of the nose and paranasal sinuses is used in:

Juvenile nasopharyngeal angiofibroma (angiofibroma). (angiofibroma)

Inverted nasal papilloma (papiloma nas inv). (inv. nas. papilloma)

Hypophysis surgery (hipófisis). (hypophysis)

Dacryocystorhinostomy (dacrio). (dacryo)

Cerebrospinal fluid fistulas (LCR). (CFF)

Orbital decompression (orbit). (orbit)

Decompression of the optic nerve (n. óptico). (optic n.)

Tables 1 to 8 and Figures 1 to 8 show the data obtained in the survey.

	Courses	Navigator
HCM	0	1
PEMEX	0	0
Naval	0	0
Español	0	1
Ángel Leaño	0	0
E. González	1	0



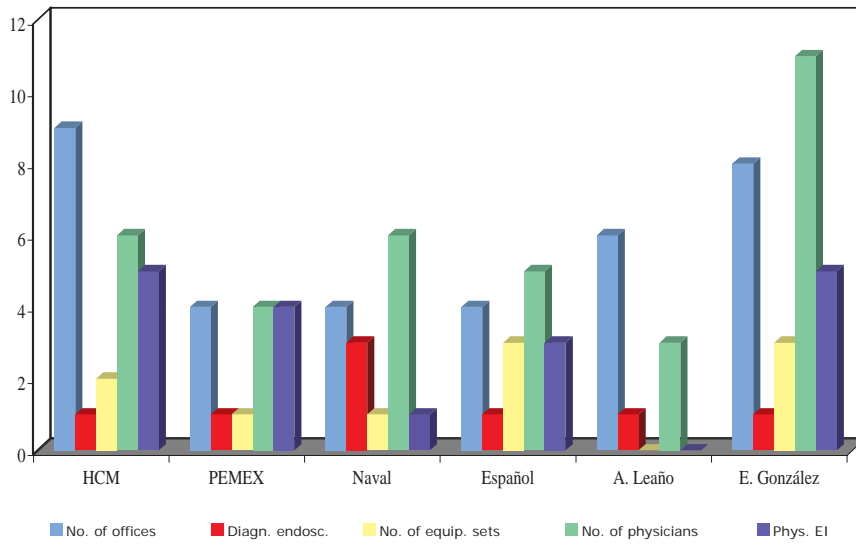


Figure 1.

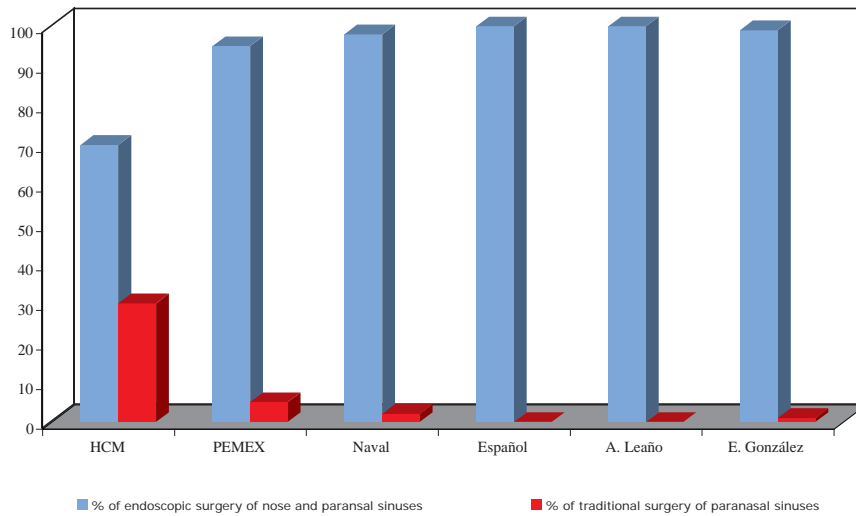


Figure 2.

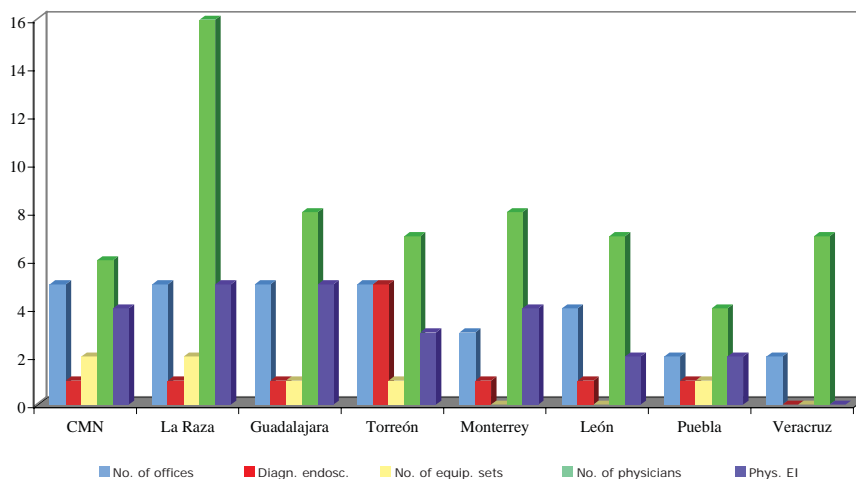


Figure 3.

## Results

The Hospital General de México (HGM) has the greatest number of offices (11) and the hospitals of the IMSS in Monterrey, Puebla and Veracruz have only two.

The majority of these institutions have four or five offices.

The hospitals with one equipment set for diagnostic endoscopy: Hospital Central Militar (HCM), Hospital de PEMEX Sur de Alta Especialidad (PEMEX), Hospital Español, Ángel Leño de Guadalajara (Jalisco), Eleuterio González de Monterrey (Nuevo León), Centro Médico Nacional del IMSS, Centro Médico La Raza del IMSS, Centro Médico de Occidente de Guadalajara, Centro Médico de León (Guanajuato) del IMSS, Centro Médico de Puebla del IMSS, Hospital 20 de Noviembre del ISSSTE, Hospital Valentín Gómez Farías del ISSSTE (Guadalajara), Hospital Ignacio Zaragoza del ISSSTE, ISSEMYM, Hospital General de México, Hospital Juárez, Instituto Nacional de Enfermedades Respiratorias (INER) and Hospital Civil de Sonora.

Institutions with two equipment sets:

Hospital Lic. Adolfo López Mateos (ALM) del ISSSTE, Hospital Civil de Guadalajara (Jalisco), Secretaría de Salud.

The Hospital Naval has three equipment sets.

Hospitals with five equipment sets:

Centro Médico de Torreón, IMSS, Hospital General Dr. Manuel Gea González, Secretaría de Salud.

The only institution that does not offer diagnostic endoscopy is the Centro Médico Veracruz, IMSS.

The institutions with one equipment set and surgical instrumentation for endoscopic intervention of the nose and paranasal sinuses:

PEMEX, Naval, Centro Médico de Occidente en Guadalajara, Centro Médico de Torreón, 20 de Noviembre, Adolfo López Mateos, Ignacio Zaragoza, ISSEMYM, Juárez and Hospital Civil de Sonora.

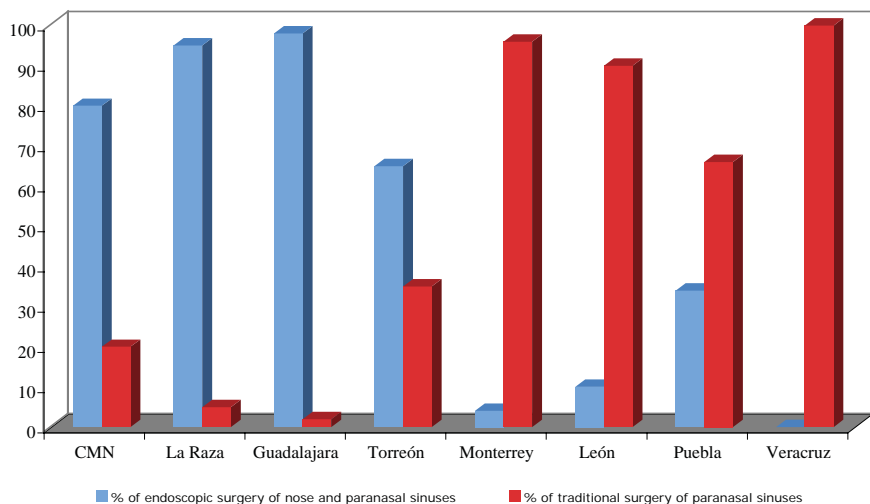


Figure 4.

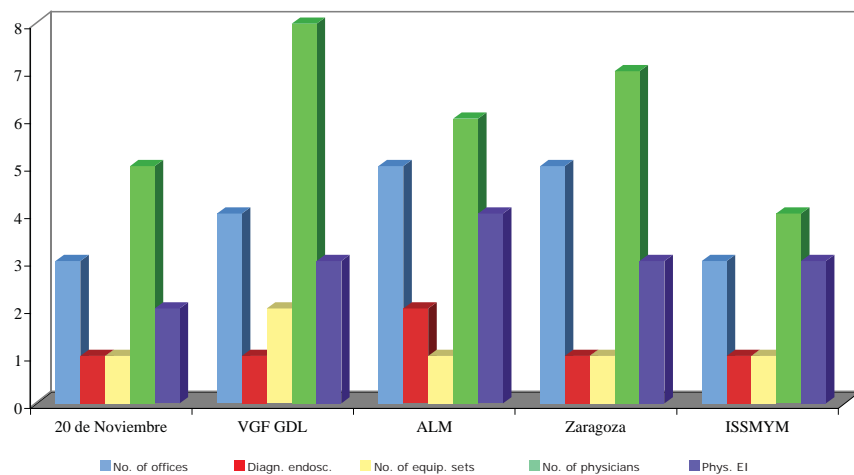


Figure 5.

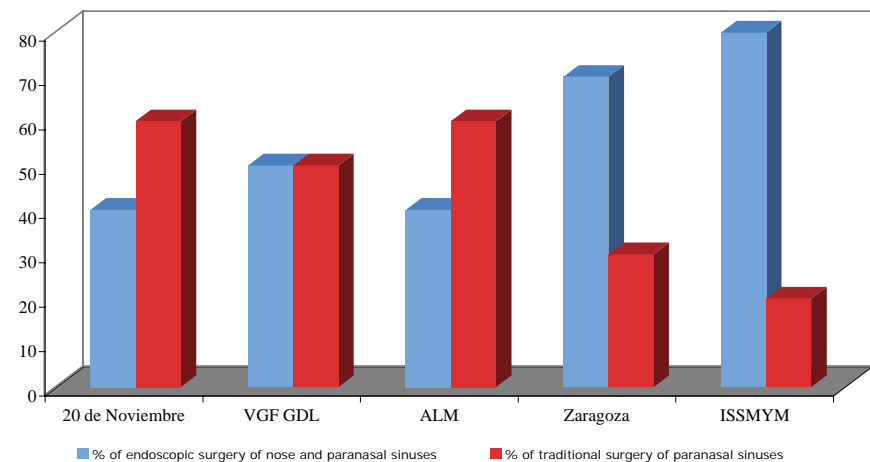


Figure 6.

Hospitals with two surgical equipment sets:

Hospital Central Militar, Centro Médico Nacional, IMSS, Centro Médico La Raza, IMSS (rented), Centro Médico de Torreón, IMSS, Hospital Valentín Gómez Farías, ISSSTE, Hospital General Dr. Manuel Gea González and INER.

Institutions with three equipment sets:

Hospital Español, Eleuterio González, Monterrey (Nuevo León), Hospital General de México and Hospital Civil de Guadalajara, Jalisco.

### Comments

The majority of Mexican otorhinolaryngology teaching institutions have equipment for diagnosis and for the performance of endoscopic interventions of the nose and paranasal sinuses; likewise, there are physicians who perform the procedure in almost all of the institutions. It is noteworthy that at two locations, the Hospital Ángel Leño de Guadalajara (Jalisco) and Centro Médico de Veracruz, IMSS, endoscopic intervention is not performed; in Veracruz they do not even have equipment for diagnostic endoscopy. On the other hand, at PEMEX, INER and the Hospital General Dr. Manuel Gea González, all base otorhinolaryngologists perform this intervention.

It is to be desired that all offices offer diagnostic endoscopy – this is very advantageous in pre- and post-graduate teaching– so that residents become accustomed to and acquire skills for management and observation using endoscopy. When these students actually take part in surgery, it is important that they have relevant previous training.

Only four institutions offer workshops in endoscopic intervention in cadavers, which is insufficient for meeting the goal of training a considerable percentage of otorhinolaryngologists in our country. This shortcoming is due to the difficulty involved with maintaining fresh cadavers, and to the fact that heads procured from

other countries are expensive, which is a problem that we should resolve in order to ensure that residents and specialists in otorhinolaryngology receive training. In the meantime, students can train using the heads of pigs, which is a suitable resource for training before training with human cadavers.

Only two institutions have surgical neuronavigators, a three-dimensional apparatus that is useful in revision surgery, hypophysis surgery and for instruction in endoscopic intervention. Although expensive, this device is a desirable resource for teaching institutions.

Of the total number of surgical otorhinolaryngological interventions, the operation of the paranasal sinuses varies between 8% and 50% and depends on the prevalence of the disease in each institution.

With respect to the percentages of traditional interventions and endoscopic interventions of the nose and paranasal sinuses, it is noteworthy that in hospitals such as “el Español,” 100% of illnesses of the nose and paranasal sinuses are cured exclusively with endoscopic intervention. At the IMSS de Veracruz and the Hospital Ángel Leño, 100% of rhinosinus conditions are treated with conventional procedures; in the other institutions the percentage of endoscopic intervention varies from 34% to 99%.

Other illnesses of the nose and paranasal sinuses, treated with endoscopic intervention, are cured in

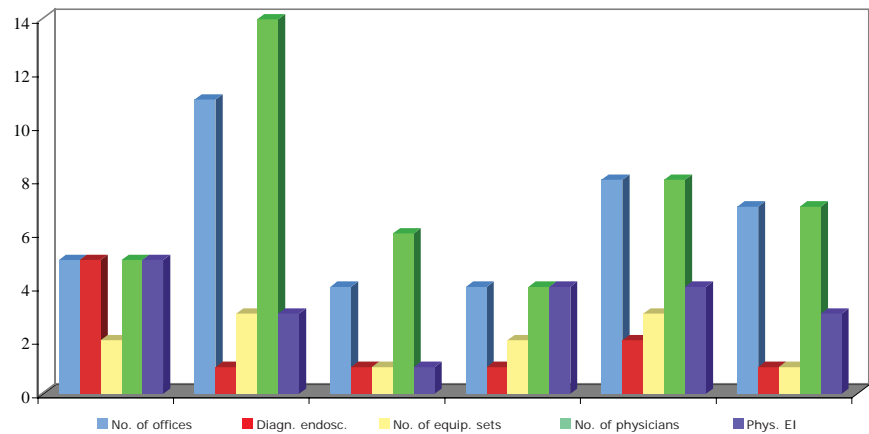


Figure 7.

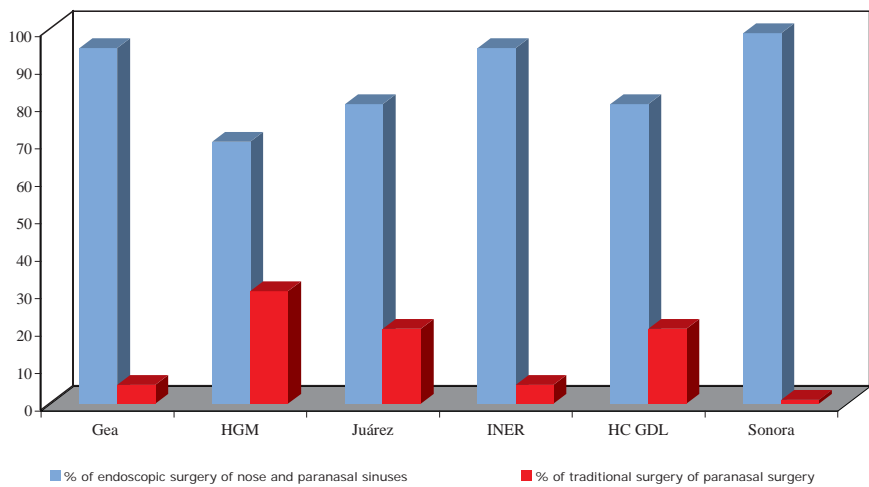


Figure 8.

the majority of the institutions with endoscopy; decompression of the optic nerve is performed at only two hospitals, and the treatments are related to the prevalent diseases at the different institutions.

As with other options for treatment and surgery developed in all branches of medicine, endoscopic intervention of the paranasal sinuses has exhibited both advantages and limitations through the years. Meanwhile, traditional procedures

	HCM	PEMEX	Naval	Español	Ángel Leño	Eleuterio González
Angiofibroma	Yes	Yes	Yes	No	No	Yes
Inverted nasal papilloma	Yes	Yes	Yes	Yes	No	Yes
Hypophysis surgery	Yes	No	Yes	Yes	No	No
Dacryocystorhinostomy	Yes	Yes	Yes	Yes	No	Yes
Cerebrospinal fluid fistulas	Yes	No	Yes	Yes	No	Yes
Orbital decompression	Yes	No	No	Yes	No	Yes
Decompression of the optic nerve	Yes	No	No	No	No	No

**Table 3. IMSS**

	Courses	Navigator
CMN	0	0
La Raza	0	0
Guadalajara	0	0
Torreón	1	0
Monterrey	0	0
León	0	0
Veracruz	0	0
Puebla	0	0

**Table 5. ISSSTE**

	Courses	Navigator
20 de Noviembre	0	0
VGF GDL	0	0
ALM	0	0
Zaragoza	0	0
ISSEMYM	0	0

**Cuadro 4. IMSS**

	CMN	La Raza	Guadalajara	Monterrey	Puebla	León	Veracruz
Angiofibroma	No	Yes	Yes	No	Yes	Yes	No
Inverted nasal papilloma	Yes	Yes	Yes	Yes	Yes	Yes	No
Hypophysis surgery	No	No	Yes	Yes	Yes	No	No
Dacryocystorhinostomy	Yes	Yes	Yes	Yes	No	No	No
Cerebrospinal fluid fistulas	Yes	Yes	Yes	Yes	Yes	No	No
Orbital decompression	Yes	Yes	Yes	No	Yes	No	No
Decompression of the optic nerve	No	No	No	No	No	No	No

**Table 6. ISSSTE**

	20 de Noviembre	VGF Guadalajara	ALM	Zaragoza	ISSEMYM
Angiofibroma	Yes	No	Yes	No	Yes
Inverted nasal papilloma	Yes	No	Yes	Yes	Yes
Hypophysis	Yes	Yes	Yes	Yes	No
Dacryocystorhinostomy	No	Yes	Yes	No	Yes
Cerebrospinal fluid fistulas	Yes	Yes	Yes	No	Yes
Orbital decompression	Yes	No	No	Yes	No
Decompression of the optic nerve	No	No	No	Yes	No

**Table 7. Health Department**

	Courses	Navigator
Gea González	1	0
HGM	0	0
Juárez	0	0
INER	0	0
Civil Guadalajara	1	0
Sonora	0	0

which could be combined with the new technologies have been maintained, as part of an effort to constantly seek the best option for our patients.

The institutions responsible for training new specialists have an obligation to offer instruction and technology at the level of the highest international standards for this specialty.

**Table 8.** Health Department

	Gea González	HGM	Juárez	INER	Civil Guadalajara	Sonora
Angiofibroma	Yes	Yes	No	Yes	Yes	No
Inverted nasal papilloma	Yes	Yes	Yes	Yes	Yes	Yes
Hypophysis surgery	Yes	No	Yes	No	Yes	Yes
Dacryocystorhinostomy	Yes	No	Yes	Yes	Yes	Yes
Cerebrospinal fluid fistulas	Yes	Yes	Yes	Yes	Yes	No
Orbital decompression	Yes	Yes	Yes	Yes	Yes	No
Decompression of the optic nerve	No	No	No	No	Yes	No

**Table 9.** Results for total number of otorhinolaryngologists who perform endoscopic intervention of the paranasal sinuses:

Institution	Total otorhinolaryngologists	Otorhinolaryngologists who perform intervention
Hospital Central Militar	6	5
PEMEX	4	4
Hospital Naval	6	1
Hospital Español	5	3
Ángel Leño, Guadalajara	3	0
Eleuterio González, Monterrey	11	5
Centro Médico Nacional, IMSS	6	4
Centro Médico la Raza, IMSS	16	5
Centro Médico de Occidente, Guad.	8	5
Centro Médico Torreón, IMSS	7	3
Centro Médico Monterrey, IMSS	8	4
Centro Médico de León, IMSS	7	2
Centro Médico de Puebla, IMSS	4	2
Centro Médico de Veracruz, IMSS	7	0
Hospital 20 de Noviembre, ISSSTE	5	2
Valentín G. Farias, ISSSTE	8	3
Adolfo López Mateos, ISSSTE	6	4
Ignacio Zaragoza, ISSSTE	7	3
ISSEMYM	4	3
H.G. Dr. Manuel Gea González, SS	5	5
Hospital General de México, SS	14	3
Hospital Juárez, SS	6	1
INER, SS	4	4
Hospital.Civil, Guadalajara, SS	8	4
Hospital Civil Sonora SS	7	3

Institutions offering annual courses with workshops using human cadavers:

Hospital José Eleuterio González de Monterrey, Nuevo León.

Hospital Regional de Torreón del IMSS.

Hospital Civil de Guadalajara of the Secretaría de Salud.

Hospital General Dr. Manuel Gea González of the Secretaría de Salud.

Institutions with surgical neuronavigators:

Hospital Central Militar.

Hospital Español de México.

**Table 10.** Results for percentages of otorhinolaryngological interventions (ORL), traditional operations, and endoscopic interventions of the paranasal sinuses (EIPN)

Institution	% of operations ORL	% traditional operations	% EIPN
Hospital Central Militar	30	30	70
PEMEX	20	5	95
Hospital Español	15	0	100
Hospital Ángel Leaña	15	100	0
Eleuterio González	20	1	99
CMN del IMSS	20	20	80
La Raza del IMSS	10	5	95
CMO de Guad. del IMSS	40	2	98
Torreón del IMSS	30	35	65
León del IMSS	20	10	90
Puebla del IMSS	18	66	34
Veracruz del IMSS	20	100	0
Monterrey del IMSS	20	4	96
20 de Nov. del ISSSTE	50	60	40
Val.Gom.Far. ISSSTE	30	50	50
A. López M. del ISSSTE	20	60	40
ISSEMYM	25	20	80
I. Zaragoza del ISSSTE	10	30	70
HG Dr. MGG SS	8	5	95
HG de México SS	15	30	70
Civil de Guadalajara SS	30	20	80
Juárez SS	10	20	80
INER de la SS	25	5	95
Hosp. Civil de Sonora SS	20	1	99

Illnesses cured with endoscopic intervention of the paranasal sinuses: juvenile nasopharyngeal angiofibroma (JNA), inverted nasal papilloma (INP), surgery for adenoma of the hypophysis (HYPOPH), dacryocystorhinostomy (DCR), cerebrospinal fluid fistula (CFF), orbital decompression (ORB) and decompression of the optic nerve (DON); results are shown in Table 11. Endoscopic interventions for rhinosinusitis and sinonasal polyposis are not included, given that 100% of the hospitals performing endoscopic intervention of the paranasal sinuses also perform these procedures.

**Table 11.**

Institution	Type of illness						
	JNA	INP	HYPOPH	DCR	CFF	ORB	DON
Hospital Central Mil.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PEMEX	Yes	Yes	No	Yes	No	No	No
Hospital Naval	Yes	Yes	Yes	Yes	Yes	No	No
Hospital Español	No	Yes	Yes	Yes	Yes	Yes	No
Ángel Leaña	No	No	No	No	No	No	No
Eleuterio González	Yes	Yes	No	Yes	Yes	Yes	No
IMSS CMN	No	Yes	No	Yes	Yes	Yes	No
IMSS La Raza	Yes	Yes	No	Yes	Yes	Yes	No
IMSS Guadalajara	Yes	Yes	Yes	Yes	Yes	Yes	No
IMSS Monterrey	No	Yes	Yes	Yes	Yes	No	No
IMSS Puebla	Yes	Yes	Yes	No	Yes	Yes	No
IMSS León	Yes	Yes	Yes	No	Yes	Yes	No
IMSS Veracruz	No	No	No	No	No	No	No
ISSSTE 20 de Nov.	Yes	Yes	Yes	Yes	Yes	Yes	No
Valentín Gómez F.	No	No	Yes	Yes	Yes	Yes	No
Adolfo López M.	Yes	Yes	Yes	Yes	Yes	No	No
Ignacio Zaragoza	No	Yes	Yes	No	No	Yes	Yes
ISSEMYM	Yes	Yes	No	Yes	Yes	No	No
HGMGG SS	Yes	Yes	Yes	Yes	Yes	Yes	No
Hosp. G. de Méx.	Yes	Yes	No	No	Yes	Yes	No
Hosp. Juárez	No	Yes	Yes	Yes	Yes	Yes	No
INER	Yes	Yes	No	Yes	Yes	Yes	No
Civil Guadalajara	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Civil Sonora	No	Yes	Yes	Yes	No	No	No

# Surgical closure of the post-laryngectomy pharyngocutaneous fistula: technique

**Luis Ferbeyre Binelfa**

*Instituto Nacional de Oncología y Radiobiología, La Habana, Cuba*

**Guillermo Sánchez Acuña**

*Hospital Universitario Calixto García, La Habana, Cuba*

**Adolfo Hidalgo González**

*Hospital Universitario Calixto García, La Habana, Cuba*

**Jorge Luis Arteaga Gattorno**

*Hospital Provincial Camilo Cienfuegos, Sancti Spiritus*

**Pablo Cruz González**

*Hospital Comandante Manuel Fajardo, La Habana, Cuba*

## Resumen

### INTRODUCCIÓN

La fístula faringocutánea, como complicación de la laringectomía radical, es relativamente frecuente. Existen diferentes técnicas quirúrgicas para cerrar dichas fístulas.

### OBJETIVO

Exponer, con base en la experiencia acumulada, algunos aspectos del tratamiento de esta complicación y detallar las técnicas e indicaciones para la misma.

### MATERIAL Y MÉTODO

Se analizaron los expedientes de 115 pacientes a quienes se hizo laringectomía radical como tratamiento de cáncer laríngeo. El material de estudio fueron expedientes de pacientes operados en el Instituto Nacional de Oncología y Radiología de La Habana, Cuba, entre enero de 1995 y noviembre del 2002. En la muestra definitiva sólo quedaron 18 pacientes.

### RESULTADOS

De 115 laringectomías radicales, 43 casos (37.3%) manifestaron fístula faringocutánea, lo que representa una cifra menor que el 65% reportado en un estudio previo. De los 43 casos, 18 (41.8%) necesitaron cierre quirúrgico y 25 (58.1%) cerraron por segunda intención. En 12 pacientes (66.6%) el intento inicial de cierre por tercera intención fue efectivo y la sonda nasoesofágica se retiró entre los 10 y 14 días del postoperatorio. Seis pacientes (33.3%) tuvieron recidiva de la fístula después del primer intento de cierre; de éstos, cuatro tuvieron cierre espontáneo de la nueva fístula antes de los 10 días posteriores a su aparición.

### DISCUSIÓN

La selección de la técnica de cierre estuvo en función de múltiples factores locales del sitio a reconstruir. Se ilustran los pormenores de cada tipo de reconstrucción y se hace hincapié en la prevención de las complicaciones. Asimismo, se hace referencia a otras técnicas reportadas en la bibliografía.

### CONCLUSIONES

Si no se logra la hermeticidad adecuada de la faringe el cierre no funcionará debido a que la salida de saliva a los tejidos genera

## Abstract

### BACKGROUND

Pharyngocutaneous fistula is the most common complication following total laryngectomy.

### OBJECTIVE

To determine the results using different surgical procedures to repair this complication, highlighting some aspects in the management of fistulae concerning techniques and indications.

### PATIENTS AND METHOD

We reviewed 115 consecutive patients who underwent total laryngectomy for squamous cell carcinoma of the larynx, most of them operated at the National Institute of Oncology and Radiobiology in Havana, Cuba. A pharyngocutaneous fistula needing surgical closure was developed in 18 patients. Information was collected from medical charts and processed in a computed database.

### RESULTS

A pharyngocutaneous fistula was developed in 43 patients (37.3%), which represents an improvement comparing our previous report of 65%. Surgical closure was performed in 18 cases (41.8%). Spontaneous closure with local wound care was achieved in 25 patients (58.1%). Twelve patients (66.6%) achieved wound closure in the first surgical attempt, and oral feeding was established between 10 to 14 days postoperatively. Pharyngocutaneous fistula developed again in six patients (33.3%) and four of them closed spontaneously.

### DISCUSSION

Selection of closure technique was influenced by several local factors at the recipient site. A review of the different techniques performed was made highlighting details concerning prevention of complications. Recent reports of new techniques in the literature were mentioned.

### CONCLUSIONS

Closure of the pharynx is important to avoid failure. The leakage of saliva through the tissues produces infection and sepsis, risking the viability of the flaps employed. The good selection and performance of these techniques, as well as the comprehensive management of the patient are the basis of success and the solution of these problems.



contaminación y sepsis, lo que pone en riesgo la viabilidad de los colgajos utilizados. La buena selección, la ejecución de la técnica, de acuerdo con el tipo de defecto, y el tratamiento general del paciente son la base del éxito para solucionar estos problemas.

**Palabras clave:**

*fístula, laringectomía, colgajos.*

**Key words:**

*fistula, laryngectomy, flaps.*

## Introduction

The pharyngocutaneous fistula as a complication of radical laryngectomy is relatively frequent. Its incidence varies from 7% to 37%;<sup>1-13</sup> however, in a previous study its incidence rose to 65%<sup>14</sup> (Table 1).

This phenomenon is caused by an abnormal communication between the pharynx and the exterior via the skin of the neck, where saliva normally empties, above all when the patient swallows. When this communication is of large magnitude, it is referred to as pharyngostoma.

The direct primary cause is filtration of saliva in any site of the pharyngoplasty, from the pharyngeal lumen to the tissues

of the neck, which is finally expressed directly to the overlying skin or forms a tract that can lead to any point in the cutaneous plane. With time, the flow of saliva to the exterior generates a migration of mucosal epithelium in this same direction, which covers the lumen of the fistula and leaves a permanent tract.

The origin of pharyngocutaneous fistulas is multifactorial, but has direct relation with a deficiency in the suture or with the scarring of the pharyngostoma which remains after radical laryngectomy. Various factors have been mentioned as causes of failure of correct closure of the pharyngeal borders, including: patient's nutritional state, intercurrent

illnesses such as anemia and diabetes mellitus, oral sepsis, involuntary postoperative swallowing of saliva, vomiting or gastroesophageal reflux, and existence of pathogenic bacteria in the skin and pharynx.<sup>14,15,16</sup> There are other variables relating to the treatment of the patient, including: previous radiotherapy, suture material, suture technique, prophylactic treatment with antibiotics, previous tracheostomy, the quantity of pharynx resected, associated radical neck procedures, and totalization of conservative surgery.<sup>5,6,14,15</sup>

The majority of fistulas are small and scar spontaneously;<sup>14</sup> however, some patients must be re-operated once or

**Table 1.** Incidence of postlaryngectomy pharyngocutaneous fistula. Bibliographic review

<i>Author</i>	<i>Year</i>	<i>No. of cases</i>	<i>No. of fistulae</i>	<i>%</i>	<i>Reference</i>
Ogura	1951	37	8	12.6	1
Kirchner	1962	20	13	50	2
Hendrick	1964	138	32	22.5	3
Dejung	1970	168	44	26.2	4
Lavelle	1972	170	64	37.6	5
Dedo	1975	117	9	7.6	6
Horgan	1978	135	20	14.8	7
Johansen	1988	106	34	32.1	8
Aprigliano	1990	625	57	9.0	9
McCombe	1993	357	84	23	10
Papazoglon	1994	310	28	9.0	11
Fradis	1995	56	7	12.5	12
Akyol	1995	110	23	21.0	14
Soylu	1998	295	37	12.5	13
Ferbeyre	2001	40	26	65	14

Source: Bibliographical material from the Centro Nacional de Información Oncológica (National Center for Oncological Information), 1995-2001.

several times to achieve closure of the communication and a timely opening of the oral pathway. The postoperative manifestation of a pharyngocutaneous fistula impedes removal of the nasoesophageal tube within the predicted time, which delays the initiation of feeding by normal means. On occasions the problem arises after removal of the tube, and repositioning is necessary. All the aforementioned factors generate malaise in the patient and delay adjuvant treatment with radiation.

There are various surgical techniques to close pharyngocutaneous fistulas.

## Objectives

Describe our experience in the surgical closure of the postlaryngectomy pharyngocutaneous fistula and place emphasis in the directions and details of each surgical technique.

Propose techniques for closure according to anatomical-surgical characteristics.

## Material and methods

A total of 115 radical laryngectomies were performed to treat laryngeal cancer between January 1995 and November 2002, the majority at the Instituto Nacional de Oncología y Radiobiología de La Habana, Cuba. Patient clinical records were reviewed and cases were selected according to the following inclusion criteria: a) patients with postoperative pharyngocutaneous fistula whose closure was not spontaneous but occurred through some surgical method, and b) minimum follow-up of six months. Patients lost during follow-up before a definitive closure of pharyngocutaneous fistula had been noted were excluded from the sample. Eighteen patients had definitive proof, all of whom underwent surgical closure of the postlaryngectomy pharyngocutaneous fistula. Data were collected from clinical records, during a survey previously designed for this purpose. The information was entered

in a database to process the different variables.

### Semantic control

Pharyngocutaneous fistula: communication between the pharynx and the exterior via the neck, with emission of saliva or positive water test.

Water test: it is used in patients to confirm hermeticity of the pharynx. Between 10 and 14 days following the radical laryngectomy, before removal of nasoesophageal tube, patients are given a glass of water, and emission of water from some part of the neck is determined. If water has been released from any part of the neck, the test is considered positive. On occasions, coloration can be added to the water to facilitate identification of the fistula. In selected cases, the test can be administered before 10 days postoperative.

Closure by first intention: achieved after the initial operation, in which tissue dehiscence never existed.

Closure by second intention: achieved spontaneously, without need for operation, after an initial tissue dehiscence caused by some complication.

Closure by third intention: surgical re-intervention to close tissue in a patient whose closure on second intention is very prolonged or impossible.

Closure on fourth intention: re-intervention before failure of closure by third intention.

## Results

Of the 115 radical laryngectomies, 43 cases (37.3%) manifested pharyngocutaneous fistula, which represents a lower figure than the 65% reported in a previous study.<sup>14</sup> Of the 43 cases, 18 (41.8%) required surgical closure and 25 (58.1%) achieved closure by second intention. No patients were lost during follow-up.

Surgical closure of the pharyngocutaneous fistula on third intention was performed in 17 men and one woman. Age range oscillated between 42 and 75 years, with a mean of 61.3 years. The waiting period between fistula appearance and the decision to operate was variable and depended on the magnitude of the opening. In small fistulas, the wait extended up to two weeks, with hopes for spontaneous closure. However, in those of greater magnitude, where spontaneous closure could be delayed for months, the decision to operate was immediate.

Table 2 shows the distribution of patients cured with the first-intention closure technique. The variety of procedures is noted, from the most simple, such as direct closure with local anesthesia (most frequent), to the most

**Table 2.** Surgical techniques used in first intention for closure of pharyngocutaneous fistula

<i>Surgical technique</i>	<i>Num. of patients</i>	<i>%</i>
Direct closure*	5	27.7
Filatov tube*	3	16.6
Supraclavicular flap	3	16.6
Deltpectoral flap	2	11.1
Pectoral flap	3	16.6
Latissimus dorsi flap	2	11.1

\* With local anesthesia

Source: Clinical histories

complex, such as the latissimus dorsi pedicle technique, as well as operations of intermediate complexity.

In 12 patients (66.6%) initial attempt at closure by third intention was effective and the nasoesophageal tube was removed at between 10 and 14 days postoperative. Six patients (33.3%) manifested recidivism of the fistula after the first intention for closure; of these, four had spontaneous closure of the new fistula within 10 days after its appearance. In these cases the tube was removed once absence of communication was verified through the water test. Two remaining patients, who initially underwent direct closure and closure with a supraclavicular flap, respectively, underwent closure on fourth intention, one with direct closure and the other with Filatov tube (figure 1).



**Figure 1.** Fistula closure with Filatov tube. The missing mucosa is reconstructed with inverted skin and in the resulting bloody area, the distal end of the skin tube is sutured.

## Discussion

Selection of closure technique was based on multiple local factors relating to the site to be reconstructed. It is important to achieve a hermetic suture, without tension, with vital tissue, and with material that is absorbent in the long term, preferably discontinuous (Vicryl 000). The size of the fistula is very important, given that it indicates the quantity of tissue necessary, and finally, the flap to be used. Another topic for consideration is the shape of the defect, because in

the case of elongated vertical fistulas, the borders can be closed easily. The existence of a tract is a phenomenon that in some occasions can be disorienting, given that the pharyngeal opening can be very distinct from the opening of the skin. This may be easy to close but if the pharynx is not closed, the pressure of the saliva in the tract eventually reopens the fistula. If a tract exists, it must be opened along its full length, until finding the pharyngeal opening, given that the closure and the hermeticity of the pharynx guarantee scarring of the skin. The elasticity of the local skin is another important variable which on occasions requires the use of a flap in small defects. This occurs in patients who have received radiotherapy, above all in high doses and in multioperative cases. Also, previous incisions can influence decisions regarding technique; in U (Gluck) incisions, the existence of fistulous tracts is more frequent and the use of the skin surrounding the fistula requires more waiting time before circulation is reestablished in the incision area. However, in vertical incisions of the middle line, the pharyngeal suture overlaps the cutaneous one, which facilitates the direct emission of saliva in the case of fistulas, and tracts rarely form. The local skin can be used immediately, given that the fistula coincides with the site of the scar and the blood circulation in the skin is favorable. It is important to change the feeding tube every two or three weeks, given that some feeding remnants may adhere to the interior and lead to bacterial contamination. Other factors relating to closure techniques include the following:

### Direct closure

In a direct closure, local skin and the actual pharynx are used to close the pharyngocutaneous fistula. It is ideal for small, large, and elongated defects, with easy closure. A part of the skin can be inverted to form the anterior face of the

pharynx, reduce tension in the suture and increase the diameter of the pharyngeal lumen, which prevents possible stenosis. In the irradiated skin it is sometimes impossible to close a small defect because of the poor quality of scarring and the lack of elasticity, in those cases it is viable to use tissue located outside of the field of irradiations.

### Filatov tube

This is an older technique. During a long period of time in the “pre-flap” era, it constituted the standard for the plastic and reconstructive surgeon.<sup>17</sup> It requires multiples steps and several weeks for complete closure, which is its principal disadvantage. It is used as a reserve technique in failed direct closures or in small recurrent fistulas after closure with a myocutaneous flap. Many times, during confection and rotation of the tube, direct closure is intentioned, which if not successful at least reduces the size of the final defect at the time of definitive closure with the skin tube (Figure 1).

### Supraclavicular flap

This is an island flap, a descendant of the epaulet flap. Its pedicle is the supraclavicular artery, transverse cervical branch, which provokes cutaneous perforations in the shoulder area.<sup>18</sup> It can be used to substitute for the pharynx or to close the defect created by the use of inverted skin in the closure of the pharynx (Figure 2). It is used for medium-sized defects, where a direct closure is impossible and a myocutaneous flap would be excessive. Its principal advantage is its fasciocutaneous constitution, which makes it very versatile. It also possesses a good rotation arc. It can be used with previous tissue expansion, which increases the quantity of available skin.<sup>19,20</sup> Its principal disadvantage is that in patients with previous neck procedures the pedicle is damaged or nonexistent, which limits its use.



**Figure 2.** Fistula closure with supraclavicular flap. The anterior face of the pharynx is substituted with inverted skin from the neck and the resulting bloody area is covered with the island of skin from the supraclavicular flap.

**Bakamjian deltopectoral flap**

Bakamjian described this procedure during the 1960s and it practically fell into disuse after the advent of myocutaneous flaps.<sup>21,22</sup> Its principal indication was for pharyngoesophageal reconstruction in circular defects, which was performed over two occasions and, in its era, improved upon the long period of time involved with reconstruction using skin tubes. It can be useful in the closure of large fistulas. It has been used for closure of skin once the pharynx is reconstructed with inverted local skin, which permits a single surgical intervention. (Figure 3).



**Figure 3.** Closure with Bakamjian deltopectoral flap. For pharyngeal mucosal closure, inverted neck skin was used.

**Pectoral flap**

Ariyan described this at the end of the 1970s. Currently, it is the standard for reconstructions of the head and neck because of its high reliability, the large amount of tissue available, and its easy technique and overall versatility.<sup>23</sup> It

is used in various ways for closure of large fistulas and pharyngoesophageal reconstruction. Its principal disadvantage is its redundancy, in men because of the high muscle volume and in women because of mammary tissue and subcutaneous fat. In pharyngocutaneous fistulas of large magnitude, the skin island can be used as mucosa for pharyngeal closure, or inverted skin can be used for the mucosa, and pectoral skin for the resulting cutaneous defect. (Figure 4).



**Figure 4.** Closure with pectoral flap. For mucosal closure, part of the same pharynx and inverted neck skin were used; the pectoral island was placed in the resulting defect.

**Latissimus dorsi flap**

The first reports of this procedure correspond to Higinio Tansini in 1906.<sup>24</sup> For many years, this procedure was limited to mammary reconstruction.<sup>25</sup> At the end of the 1970s, the first reports on its use in the head and neck were published.<sup>26,27</sup> It involves a large quantity of skin for defect reconstruction, including total pharyngoesophageal reconstructions.<sup>28</sup> It is less redundant than pectoral flaps but its dissection is more labor-intensive and the pedicle remains highly exposed, which increases sensitivity to venous thrombosis from sepsis, above all when there is recidivism of the fistula.<sup>29</sup> It has been used in the closure of the anterior pharyngeal circumference, which uses a free graft for the defect of lost skin (Figure 5).

Other techniques for the closure of fistulas have been described, such as the sternocleidomastoid flap<sup>30,31</sup> and the platysma flap<sup>32</sup> for medium-size defects. Less frequently mentioned are the temporoparietal fascia flap<sup>33,34</sup>



**Figure 5.** Fistula in patient with total laryngectomy for sepsis-induced dehiscence and necrosis of the hyoid associated with *Pseudomonas aeruginosa* sepsis after a subtotal laryngectomy with cricohyoidopexy. The defect was reconstructed with a latissimus dorsi flap, with a skin island used to substitute for the lost anterior pharyngeal hemicircumference; a free graft was used for the skin. Observe the aspect of the donor site.

and others used for microsurgical techniques, such as the radial and the jejunum patch.<sup>35,36</sup>

## Conclusions

Closure of pharyngocutaneous fistulas through reconstructive surgery has a fundamental particularity: saliva. This peculiarity converts it into a contaminated surgery with a tendency for higher morbidity, above all if the terrain is unfavorable, as occurs in many cases (operated, radiated, septic, fibrotic, etc.). Currently, the use of neo-adjuvant treatments with concomitant chemoradiotherapy in advanced tumors makes recovery surgery a riskier procedure with a tendency for complications.<sup>37</sup> If adequate hermeticity of the pharynx is not achieved, the closure will not function, because the drainage of saliva to the tissue generates contamination and sepsis, which puts the viability of the flaps at risk. While sound technique is important, the general preparation of the patient is also important, that is, the patient should be well fortified nutritionally, take food supplements and receive treatment for concomitant illnesses. Likewise, local treatment with adequate antiseptics and prophylactic antibiotics is fundamental. Good selection, execution of technique (based on defect type), and general management of the patient form the basis of a successful solution to these problems. Based on acquired experience in prevention and treatment, there should be an intent to avoid possible complications, in order to avoid the necessity of resolving such problems; otherwise it would become necessary to treat the complications arising from the complications.

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# Otorhinolaryngology in older adults

David Montes de Oca Rosas

Cuadro Básico de Medicamentos, IMSS

Eduardo Montes de Oca Fernández

Academia Mexicana de Cirugía

## Resumen

*La población del mundo envejece. Cada día aumenta el número de médicos de la tercera edad que ejercen la otorrinolaringología. Para todos son evidentes los cambios en el organismo que ocurren con el paso del tiempo. Sin embargo, en la bibliografía mundial son muy escasas las publicaciones de otorrinolaringología enfocadas a los cambios del adulto mayor. En este trabajo se hacen algunas consideraciones de los padecimientos particulares de este grupo. La inversión en la pirámide demográfica y sus consecuencias son innegables, y aumenta la incidencia y prevalencia de los casos de geriatría otorrinolaringológica y de su tratamiento inadecuado.*

## Abstract

*The population of the world is aging. It is increasing the number of physicians on the third age that exerts the otolaryngology. For all of us, the changes in the organism happening with the passage of time are evident. Nevertheless, in literature worldwide there are few publications of otolaryngology, focused on these changes and this group of age. Some considerations become on the special pathology of the elder adult. Despite of the investment in the demographic pyramid has undeniable consequence, such as the increase in the incidence and prevalence of the cases of geriatric otolaryngology and the inadequate treatment of such.*

Palabras clave:

otorrinolaringología, tercera edad.

Key words:

otolaryngology, aging.

## Introducción

According to the World Health Organization (WHO) the aging of the world's population continues to increase,<sup>1</sup> an occurrence that affects the entire population.

For this single reason, there is an increase in the incidence and prevalence of otorhinolaryngological conditions in older adults. In the United States, people of the so-named "third age" represent 12% of the population, but occupy: 30% of doctors' time, 24% of administered medications and 40% of hospitalizations.<sup>2</sup>

In 1996, the staff of the Journal of the American Medical Association (JAMA) undertook a survey of the 80 most important medical journals in the world and concluded that aging was the principal topic of concern.<sup>3</sup>

There are very few publications that specifically address the theme of geriatric otorhinolaryngology in the worldwide literature, with the exception of rhinologic intervention.<sup>4</sup>

We will begin by attempting an analysis of otorhinolaryngologists who are in the third age, given that in our field

no such analysis has been undertaken. Ward<sup>5</sup> reports, according to results from 863 otorhinolaryngologists over 60 years of age, that these physicians have more longevity in comparison with those from other specialties. Another advantage noted is that these physicians can continue with their professional practice; the medical aspects of the specialty guarantee and facilitate practice during a longer period of time. Among cited causes for retirement are loss of vision and physical strength, and trembling of the hands. Ward also reports that the best time for retirement is "one year before incompetence" and that "the same factors of incompetence make judgment difficult and erroneous in the autoevaluation of retirement."

## Generalities

Old age has been defined as "an attribute, universal and endogenous, which is characterized by a biochemical and physiological process that leads to the shutdown of body systems and with that, death."<sup>5</sup>

The error theory, which explains aging, postulates that cellular multiplication produces DNA disorders and eventually

leads to the death of the organism in conjunction with oxidative biochemical changes of the cell.

The older adult has more chronic-degenerative disorders, for which reason he has more baseline prescriptions. The majority of the geriatric texts ignore the abundance of otorhinolaryngological conditions.

People above 65 years of age ingest more medications and remedies, with or without prescription, than younger people. Also, they tend to have more long-term chronic conditions, such as: arthritis, diabetes, hypertension and cardiac conditions.

In older people, medication is complex and in many cases this is not taken into consideration. The metabolism of medications is much different from that in people of other ages, because the body also is distinct; there is more fatty tissue, the body has a lower quantity of water and muscle, and the liver and kidneys function less efficiently. All of these factors imply a distinct tissue absorption and distribution, as well as slower and more difficult elimination. For these reasons, the physician should personalize

medications. It is necessary to take into consideration other factors, such as: that the patient may live alone, in poverty, with depression, dementia or other psychiatric illnesses. Older people very commonly take different medications at the same time, because they have more than one disease or disability concurrently.

It is also important to prioritize treatments – do not leave them to the judgment of the older patient –and eliminate unnecessary medications.

For all these reasons, prescriptions in the older patient should be decided upon carefully, especially with respect to contraindications, overdose, and side effects. It is necessary to avoid self-medication and provide a comprehensive treatment.<sup>6</sup>

With respect to anesthesia and surgical interventions in the patient it is necessary to take into consideration the patient's general state, especially cardiopulmonary evaluation, cardioangiosclerosis and pulmonary emphysema, given that these facilitate transoperative and postoperative complications. Blood pressure is more labile and postoperative recovery is slow.<sup>7</sup> Specific postoperative complications, such as cognitive damage, are mentioned.<sup>8</sup>

Treatment before, during, and after intervention has not been studied in interdisciplinary form, for which reason the American Society of Geriatrics convened a meeting of 10 physicians from distinct specialties, including otorhinolaryngology, to study anesthetic problems affecting older adults.<sup>9</sup> The most frequent postoperative complications are: delirium, thromboembolism, dehydration, infection and inadequate pain management.<sup>10</sup>

However, Willard<sup>11</sup> mentions that age per se should not determine whether or not an intervention is undertaken; it is necessary that the judgment of the surgeon prevail with respect to opportunity and type of surgical procedure used. In the following sections

I will discuss the principal age-imputed otorhinolaryngological illnesses:

### **Presbycusis**

This is relevant because of its repercussions in the quality of life of the older adult, its high incidence and prevalence, and commonly occurring consequences such as isolation, which can lead to depression, frustration, passivity, and a deceleration in cognitive function. This set of clinical symptoms constitutes one of the most important otorhinolaryngological problems. The new technology offered in hearing aids is digital, and the concept of “compression hearing aids” is useful and practical in modern devices. The principal problem related to their use in our country, as with other modern technological advances, is the socioeconomic limitation that affects the majority of our population. In developed nations, telephonic accessories are commonly used, for television, etc., and improve quality of life in subjects with presbycusis, particularly those with hypoacusis.

### **Presbyastasis**

This is an equilibrium disorder secondary to age. It is produced by degenerative vascular changes in the neuroepithelium of the posterior labyrinth and by diminishment of the cellular population of this tissue. Third-age people also have ataxia through diminishment of Purkinje cells in the cerebellum. The aforementioned, added to the loss of strength through senile muscular atrophy, provokes falls in the older person and insecurity when walking. Falling is one of the principal causes of hip fractures and pneumonia as a mortal complication.

Of all the chronic degenerative processes that cause this dangerous disease and cause disability, other now forgotten conditions may be included, such as: voluntary, professional or medication-related trauma and poisoning.

According to Coppa<sup>12</sup> other factors such as vestibular alterations, hip fractures and risk of new fractures should be recognized. There should be insistence upon the prevention of these dangerous problems in the equilibrium of the older adult, through neck exercises, and exercises of the entire vestibulospinal and vestibulocerebellar pathway.<sup>13</sup>

### **Presbyosmia and presbygusia**

With age, as a consequence of neuroepithelial changes in the nose and the taste regions, hyposmia and hypoacusis can result. There is an increase in the olfactory and gustatory thresholds because of neuroepithelial degeneration and alterations in the neurotransmitters and nervous pathways.

Presbygusia is potentiated by presbyosmia, given that the olfactory sense is largely responsible, from a neurophysiological viewpoint, for the sense of taste. It also contributes to the diminishment of the sensitivity of the oral cavity of the third-age adult.<sup>14</sup>

### **Presbylarynx**

This is responsible, as is presbycusis, for communication problems of the older adult and for its previously described consequences. According to Bloch<sup>15</sup> its diagnosis is by exclusion and is performed through video stroboscopy. Laryngeal atrophy is described, as well as incomplete closure of the glottis and alteration of the folds of the laryngeal mucosa.

### **Presbypharynx**

Difficulties in deglutition in the older adult can cause severe problems, such as bronchoaspiration and, therefore, chronic cough and tracheobronchitis. Diverse neurological conditions, secondary to advanced age, can contribute to dysphagia, which also is favored by sensory diminishment in the mouth, pharynx, and hypopharynx.<sup>16</sup> The previously mentioned factors deteriorate



deglutition, respiration, and vocalization in the older adult.

### Age-related changes of the nose

As with the rest of the body, with age the nose changes internally and externally. Nasal symptoms in the third-age adult are very frequent. Chronic sinusitis occupies the seventh position in morbidity in this group. Also more frequent in this age group than in younger people are nasal polyps, anterior and posterior rhinorrhea, epistaxis, and nasal crusting.

The limited medical literature only mentions partial changes in the third age, for which reason these problems are little studied and recognized; however, the nose becomes vulnerable to diverse diseases.

In 1944, Hollender<sup>17</sup> described subepithelial changes that consist of reductions of lymphatic circulation. With electronic microscopy, Kushnick<sup>18</sup> found a reduction in hair cells in individuals of advanced age which, with other viscoelastic changes, predispose the older adult to nasal crusting. González Ulloa<sup>19</sup> stated that the descent of the nasal lobe with age is caused by the lassitude of the skin and the variability of nasal width and length as a result of malar and alveolar changes.

Eldestein<sup>20</sup> indicates that the nose changes internally and externally. On the interior the nasal cycles, air currents, inflammations and allergens make it very difficult to evaluate rhinological changes that manifest with age.

Upon studying septal nasal changes in three advanced age groups, Vetter<sup>21</sup> mentioned greater cellular growth in the anterior axis and greater frequency of chondrocytes in older adult patients, which affect the nose in the airflow.

Sakakura<sup>22</sup> studied mucociliary function in 30% of patients over 30 years of age and found it to be diminished.

Functional changes of the nose with age are notable. Gustatory rhinorrhea, characterized by an increase in nasal secretion during alimentation, is greater

in older people. Rhinomanometric studies indicate greater nasal resistance with age. This function is also affected by the aging process of the lower respiratory tract which damaged ciliary motility. All of the aforementioned factors explain the frequency and fluctuations of the nasal symptoms of older people which should be considered upon prescribing medications, given that hypertension medications and diuretics dry the nose and thicken the nasal mucous. This same effect is produced by vasoconstrictors and antihistamines.

### Geriatric rhinitis and allergy

This nosological illness is very frequent, underdiagnosed and often poorly treated.<sup>23</sup> Atrophy of the nasal cartilage of the submucosal tissue, and of the mucosal glands, thickens the nasal mucous and leads to postnasal drip, chronic cough, foreign body sensation, laryngeal irritation, and scratchy throat. Diminishment of microvascular blood flow causes dryness and nasal crusting. Differential diagnosis should be performed for allergic rhinitis, vasomotor, and chronic sinusitis; antihistamines and corticoids are contraindicated. Treatment of geriatric rhinitis consists of humidifying the nose of the older person through simple methods.

### Rhinoplasty in advanced age

For the aforementioned reasons, nasal intervention presents special challenges for the rhinological surgeon. This type of patient has different expectations and motives than younger patients. Conditions of the third age make it necessary to place special emphasis in making preoperative discussions honest and realistic.

As well as changes in skin and the nasal lobe, with age there are also transformations in facial aesthetic proportions which merit different surgical techniques. Skin changes secondary to age owe to accentuation of lobule ptosis and

dorsal hump. Surgical goals should be much more conservative in this age group, given that scarring is slower, and the skin is thinner and more difficult to manipulate. Patients requiring rhytidectomy should have an appropriate general state of health that guarantees a favorable postoperative evolution.

Osseous surgical treatment should be careful and as un-invasive as possible, given that bone scars much more slowly than in young adults.

Getchel<sup>24</sup> found that in patients older than 60, immunoreactivity decreases; with age the response deteriorates progressively because of lack of lymphocytic efficiency and structural cellular changes, especially of the T lymphocytes. This facilitates rhinosinusual infections with posterior rhinorrhea.<sup>25</sup> The deteriorated systemic conditions in the older person, as well as self-diagnosis, self medication, and aggregated factors such as dehydration and allergies, make these conditions more difficult to treat within geriatric otorhinolaryngology.

There are multiple causes of aging of the skin, especially genetic and environmental factors. Cellular mitotic activity is diminished, which leads to its evident atrophy, induced by DNA changes. Ionization and radiation of ultraviolet solar rays unleash free radicals, a process which favors malignancy. The use of solar protectors is highly recommended during advanced age, otherwise the effects would be: delayed scarring and less defense against infection, seborrhea, keratosis and hemangiomas. These factors should be analyzed before making incisions of the facial skin.

Osseous surgical treatment should be careful and as un-aggressive as possible, given that bone scars much more slowly than in young adults.

In the only geriatric otorhinolaryngology study reported at the last International congress, Marioni<sup>26</sup> indicated that there is a greater incidence of concomitant systemic illnesses and of

complications in the neck during the third age, as deep neck infections.

Oncological cellular behavior is different in this age group. The search for medical treatment in these cases is more delayed. Nonsquamous tumors of the thyroid and salivary glands are more common. The following issues make treatment more difficult: cancerous problems owing to delayed diagnosis, anxiety relating to cost, social isolation, on some occasions the lack of a personal physician, and catastrophic attitudes.

## Conclusion

It should be taken into consideration that the aging process is progressive, irreversible, and mortal, and that this process includes the area of the head and neck. These anatomophysiological changes have been little studied and described, for which reason they are not given sufficient importance. The otorhinolaryngologist should treat the older patient in a special, comprehensive manner. The body and metabolism of a third-age patient are different from those of middle age and younger adults, and require a different therapeutic and pharmacological approach. Even if treating the same illnesses, the physician should not use the same pharmaceuticals nor the same doses as for a younger adult. For this age group, medications should be personalized, controlled, efficient, without risk, and administered carefully. In summary, it is necessary to treat the older adult with otorhinolaryngological problems with: better clinical study, better comprehension of the illness, and more warmth, quality, patience, and humanity.

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# Study of agraphia. Classification of writing impairments and their rehabilitation

Norma A. Sánchez Cortés

Instituto de la Comunicación Humana. Centro Nacional de Rehabilitación

## Resumen

*La exploración clínica del lenguaje escrito debe formar parte del examen general del estado mental de pacientes con afasia, con trastorno intelectual, de la memoria, etc. El objetivo de este artículo es dar a conocer la caracterización de las alteraciones del lenguaje escrito, desde su adquisición en la normalidad hasta las diferentes manifestaciones en la enfermedad, y de las clasificaciones de la actividad lingüística escrita propiamente dicha (susceptible de alterarse de forma aislada), que se muestra en todo su esplendor en el estudio del lenguaje. Una lesión cerebral puede originar un trastorno exclusivo del lenguaje escrito. Esos pacientes son los que más pueden ayudar a conocer la organización cerebral de los procesos de la lectura y la escritura, dado que tienen alteraciones no afásicas pero manifiestan pérdida o alteración de la habilidad para producir lenguaje escrito, consecuencia de algún tipo de daño cerebral. Cuanto más específico es el estudio del trastorno del lenguaje escrito, más difícil se vuelve incluir el caso en una determinada forma clínica. Las manifestaciones lingüísticas anormales pueden crear confusión, no sólo como signo clínico sino también a la hora del diagnóstico, clasificación y enfoque evolutivo de los trastornos del lenguaje escrito. En este artículo se expone la diversidad semiológica de la agrafia (al menos de las formas clínicas más relevantes) y su rehabilitación.*

### Palabras clave:

agrafia, alteraciones de la escritura, rehabilitación.

## Abstract

*Clinical exploration of the written language should be part of the general exam of the mental state in patients with aphasia, and with intellectual or memory dysfunctions. The purpose of this article is to show the characterization of the written language alterations, from its acquisition in normal conditions until the different manifestations in the disease, and of the classifications of the written linguistic activity (susceptible of suffering alterations), which is shown in the study of the language. A cerebral lesion can cause an exclusive dysfunction of the written language. Those patients can be useful to know the cerebral organization of the writing and reading processes, since they have not aphasic disorders but they do present loss or alteration of the ability to produce written language, consequence of some type of cerebral damage. The more specific the study of the written language dysfunction is, more difficult is to include the case in a certain clinical form. The abnormal linguistic manifestations that appear in the patients can provoke confusion, not only at a clinical/semiological level, but also in the diagnosis, classification and evolutionary view of the written language disorders. In this article we present the semiological diversity of agraphia (at least in the most outstanding clinical ways), as well as its rehabilitation.*

### Key words:

agraphia, writing alterations, rehabilitation.

## Introduction

Written language is an organized and voluntary action that entails conscious analysis of sounds. At first, it is developed gradually, but later it becomes a complex automated habit.<sup>1</sup>

Writing implies an understanding of language codes, an ability to convert phonemes to graphemes, knowledge of the graphemic system, adequate fine motor skills and a special capacity for distributing, joining, and separating letters. There are three specific types of written language: spontaneous writing, writing to dictation and copied writing. These writing types require different types of analysis;

the act is properly carried out through a chain of links.

The abilities required for the process of writing include auditory recognition of letters and words, searching and visual scanning once the word is written, auditory figure-ground perception, auditory sequence perception, auditory phonetic discrimination, auditory memory, auditory verbal understanding, auditory sequential skills, repetitive language, writing fluency, right-left orientation, tactile sensitivity, tactile or stereognostic form recognition, dactylar localization, reaction times and lateral preferences. The process involves distinct links, in all writing the first link

is the conservation of phonemic hearing, which is indispensable for analysis of the acoustic composition of the word.

The conservation of sound order represents the next link; in this, the task is to analyze the consecutive acoustic complex that constitutes each word.

The third link is the inhibition of strong components; this process is altered when there is debilitation of active inhibition. Later, there is recodification of phonemes in optic elements (graphemes), with their motor execution. Each grapheme has its own visuospatial structure and for this process, complicated special analysis is required.

Guriánov and Pantina show that the motor organization of writing and each graphic element requires a special impulse, and afterwards a generalization of the motor act and its fusion within a kinetic melody, where the strokes of each letter are the object of writing the entire word and at times of a phrase, and then no longer a conscious process.

Other contributions, such as psycholinguistic models, incorporate two processes in writing: one related with the semantic route which implies more holistic strategies and which is considered a direct route of access to meaning, and another which is considered an indirect route to the meaning, which is performed through the grapheme-phoneme conversion route and which uses analytical strategies.<sup>2</sup>

According to dual route psycholinguistic models, repetition, reading, and writing can be measured through the corresponding sublexical procedures of phonological auditory conversion in grapheme-phoneme conversion repetition for reading and for lexical procedures. Sublexical processes give stability to the lexical process, therefore, impairment of the former implies instability of the latter, which produces semantic errors. The impairment of the lexical process leads to regularization of orthography.<sup>3</sup>

Various researchers have undertaken neuroscientific studies and have described what happens with Spanish with respect to graphic representation.<sup>4</sup> Spanish, as used in Mexico, has 28 graphemes and 22 phonemes and its relationship is as follows: 14 phonemes have a one-to-one correspondence (one spelling per phoneme), in the remaining ones (/b/, /s/, /g/, /i/, /j/, /k/, /r/, /v/) there are two or more graphic possibilities, dependent in some cases upon combination rules.

Within the Russian school of knowledge, Luria describes writing as a systemic act that allows presupposition of the diversity of forms of disturbance

in the writing processes in cases of injury in distinct regions of the brain, regions which are necessary for performing this complex act. The writing process allows for two conclusions:

1) Variations in writing indicate that this process changes with respect to psychophysiological composition at distinct stages and that the participation of different cortical systems in this act does not remain immutable.

2) The heterogeneity that distinguishes the structure of writing within different linguistic systems are hieroglyphs, which create a basic difference in the structure of the psychophysiological processes through which this is performed. Chinese writing totally excludes the necessity for phonemic analysis of words, but as the conventional signs designate concepts, visual analysis of hieroglyphs is required. With European languages, such as Russian, German, and Italian, acoustic writing has very distinct mechanisms from those such as French or English, in which the conventional components, and not the phonetic, of writing are represented.<sup>5</sup>

The process of writing in different languages requires us to presuppose the varied defects that may appear to be associated with different focal injuries of the cerebral cortex.<sup>6</sup>

When the subject has cerebral injury and the writing process is altered as a unique illness, symptoms of agraphia appear, which are described as “the loss or impairment of the ability to create written language as a result of cerebral damage of some sort.” This could manifest through various non-aphasic impairments<sup>7</sup> and the patient should be studied during the writing process to determine which areas and zones were affected, as well as to understand the chain of links that was affected.

Beauvois and Dérouesné<sup>8</sup> explain that in the case of writing, the units of the lexical and nonlexical routes, as well as the impairment of one route or the other implies specific characteristics. In

lexical agraphia the direct route of access to the semantic is affected and causes errors in the writing of words. Among the characteristics of this type of agraphia, it is observed that the subject utilizes the nonlexical route and, therefore, the probability of correctly writing a word depends on the level of predictability of its orthography through the use of nonlexical procedures, that is, of grapheme-phoneme conversion procedures.

The orthography of high frequency words is better than that of low frequency words.

It can be observed that the focuses of the various schools with respect to the writing process consider distinct impairments caused by cerebral damage or injury; more study of these aspects is necessary.

The investigation of the writing process precedes the exploration of the analysis and synthesis of sounds;<sup>9</sup> it is carried out in this manner:

Investigation of the analysis and synthesis of sounds

1) Determine if the patient conserves the ability to divide sounds of oral language and abstract secondary phonemes upon separating stable phonemes, conserve their sequence, and if possible, group them.

2) Determine if articulatory support exists. The previous task is assigned, with a variant: that it be performed with the mouth closed.

3) Separate the sounds of the word: the patient will have to identify the second sound of the word mentioned, and then say the third and so forth.

4) Study the position of the sound within the word: it is analyzed with the instruction that it should be known which sound will precede the determined letter. This can be altered when the sound of the word and the consecutive scheme which composes it are captured. The aforementioned does not occur in cases of semantic apraxia, because these concepts are disturbed.

5) Synthesize sounds: an entire syllable or word is pronounced by letters and the patient is asked to say which syllable or word was heard.

Disturbance of the analysis and synthesis of sounds could be located in the temporal regions of the left hemisphere (not in the injuries of the middle or lower sectors of the temporal cortex of the left hemisphere).

In severe cases the patient cannot say the number of sounds, which sounds these are, nor analyze their interrelatedness.

In less severe cases the patient can understand and capture words but cannot analyze their phonetic composition, and if articulation is excluded, the overall possibility of execution is disturbed. This also occurs in acoustic synthesis.

In the posterior areas of the left sensorimotor region, impairment of analysis and synthesis goes hand in hand with impairments of the kinesthetic base of the verbal act. Analysis of the sounds that form the word reveals difficulties, the patient omits the principal sounds and the secondary articulatory components stand out, which results in an incorrect articulation.

In cases of injuries of the premotor region of the left hemisphere and of efferent motor aphasia, analysis of sonorous composition of the word is obstructed by impairment of dynamic stereotypes, which imply the sounds that compose the word, and the pathological inertia of the nervous processes given in the motor analyzer.

With injuries of the frontal and frontotemporal sectors of the left hemisphere, impulsivity constitutes the debilitation of inhibition processes and insufficient control of the result of those actions, therefore, defects in sound analysis and synthesis appear, although audition and articulation are conserved.

Once analysis and synthesis of sounds has been explored, writing is studied.

## Investigation of writing

The investigation of writing includes a series of tests directed toward different elements and levels of writing and is undertaken after evaluation of the analysis and synthesis of the sounds of the word.

1) Copied letters and words: these are presented visually (examine optic-gnostic and motor impairments, diminishment of activity in the patient, and echopraxic character of patient's actions).

The subject is instructed to copy letters, syllables and words in script and print, stylized and cursive.

2) Fine movement conservation: write the signature or some word that has already been converted in motor stereotype. Observe if there is conservation of the faculty for executing kinetic melodies or if there are perseverence symptoms.

3) Writing of letters to dictation: phonemes are dictated and process is concluded with dictation of sounds pronounced with less clarity. The patient has to decipher them and it should be observed whether he verbalizes immediately, spontaneously or after a period of time, focusing also on pronunciation, difficulties and errors.

4) Writing of syllables and words to dictation: first, sound combinations that have no meaning are proposed, which have a purely auditory character. Later, syllables are dictated where they converge with more consonants, and finally, complex and unknown words are enunciated.

5) Writing to dictation of series of words and phrases: this involves a more complex deciphering of oral and written language. Word sequences may be lost.

6) Written language in the actual meaning of the word: the patient is asked to write the name of an object.

## Symptomatic description in brief of writing processes, based on injury region

1) *Injuries of the left temporal region.* There is impairment of phonemic hearing and sensory aphasia. Cannot write isolated letters to dictation, has errors in selection of sounds heard, and difficulties writing syllables with complex acoustic structure. Articulations are not useful as aids; there is success in the writing of consolidated words, but omission of the following sounds. Cannot distinguish sounds isolated from the flow of consonants and permutes location of sounds. There is discussion of symptoms of writing impairment typical of temporal aphasia.

2) *Impairments of the kinesthetic base of verbal language (afferent motor aphasia).* There is writing of isolated letters, with diffuse articulations and difficulty in the writing process. Articulatory substitution and refusal to write a sound are symptoms that permit the determination that there is impairment of the kinesthetic writing base. The kinesthetic traces produced upon writing in silence are defective.

3) *Writing impairments when there is efferent motor aphasia (lower areas of the premotor zone of the left hemisphere).* The fluidity of the kinetic melody is altered in writing, letters can be written to dictation in isolated form but not in complex syllables or in words. The correct order of letters is lost and their position is changed upon reiteration.

4) *Occipital, temporo-occipital and parieto-occipital region injuries of the left hemisphere.* There is difficulty in recodifying the system of discovered phonemes and passing them to graphemes. There are visuospatial impairments, difficulty in writing the necessary letter, some isolated elements that make up the letter are written in inadequate spatial relationships and the letters are mirror written (copied and to dictation). This is typical and can help in the topographical diagnosis of injuries.

5) *Injuries of the frontal areas.* There are no specific direct writing

impairments. Fatigue and inactivity diminish motor tone, a phenomenon of initial writing and micrographies, the purpose of substituting required actions is lost, and reiterations alter writing.

Roselli and Ardila mention and describe different types of agraphia. Based on the different manifestations, they are classified in aphasic and non-aphasic agraphia and in other writing impairments.

## Aphasic agraphia

Agraphia in Broca aphasia: writing is limited, difficult, clumsy, abbreviated and nongrammatical, with literal paraphasia, repetition and omission of letters; letters are poorly formed.

Agraphia in Wernicke aphasia: literal and verbal paraphasia, with abundant neologisms and written paragrammatism. Agraphia in conduction aphasia (Luria, afferent motor): better spontaneous writing which worsens with dictation. There is literal paraphasia upon writing phonologically complex words, literal substitutions, additions and omissions of letters in a single word. Likewise, there is self-correction but the patient does not remember how to write, writes slowly and writes more letters than words. In the case of apraxic agraphia, the patient cannot write letters because he has forgotten the necessary movements.

Psycholinguistic models have described three types of agraphia:

a) Phonological agraphia: disorder in the conversion of phonemes to graphemes, inability to spell high-frequency, regular and irregular words. Roeltgen<sup>10</sup> relates phonological agraphia with damage to the supramarginal gyrus and medial insula.

b) Lexical agraphia: difficulty writing irregular and ambiguous words. Damage in the angular, parietooccipital and precentral regions.

c) Profound agraphia: impairment of writing because of incapacity for spelling

functional words and words without meaning, and because of the existence of semantic paraphasia. It is also associated with phonologic aphasia. The lesion site is in the supramarginal gyrus and medial insula, although the angular gyrus is involved in more extensive injuries. The writing functions of the right hemisphere are manifested in the case of profound agraphia.

## Non-aphasic agraphia

a) Apraxic agraphia: there are errors in orthography and reiterations of letters. Apraxia is observed in copied writing, spontaneous writing and writing to dictation. This can appear without ideational and ideomotor apraxia.

b) Visuospatial agraphia: it is characterized by reiterations of strokes and letters (spatial aspects) and by an increase in the left margin (unilateral spatial negligence).<sup>11</sup>

It is seen in cases of right hemisphere injuries. About 50% of the patients with prerolandic injuries and 75% of those with retrolandic injuries have writing difficulties.

Spanish speakers with right-side injuries may manifest disorthography, which ranges from mild to severe. Patients with right-side lesions change handwriting after cerebral damage, from cursive to print, and write each letter as a separate unit, as if a motor disautomation had occurred. This also occurs with the signature, which is an automatic act.

c) Motor agraphia. Motor impairments in writing are the result of central nervous system injuries that involve the basal nuclei, the cerebellum and the corticospinal pathways, or injuries that affect the peripheral nerves and mechanical structure of the hand.

## Other writing impairments

a) Hemi-agraphia: callosal section as a treatment for controlling epilepsy or for removal of a tumor alters left-hand

writing and leaves right-handed writing ability intact. It has been suggested that the left hemisphere, important for language and motor activities, it is necessary for left-hand writing.<sup>12</sup>

Left-hand agraphia is observed in cases of callosal body.<sup>13</sup>

b) States of confusion: patients in an acute state of confusion, due to various causes, can speak, understand direction, repeat, name and read but are incapable of written expression.<sup>14</sup>

Correct and specific distinction between different writing impairments allows for an understanding of the altered links and indicates a treatment that allows the patient to reestablish said function.

## Rehabilitation

Within the bibliography there are two principal types of studies. The first describes the profile of spontaneous recuperation in patients with reading and writing defects, which result from illnesses; and the second type is focused on the analysis of changes obtained in reading and writing after implementation of a particular rehabilitation method. Two principal strategies have been proposed for rehabilitation:

1) Reactivation of the lost function.

2) Development of an alternative strategy which achieves the same performance through an alternate route.

The majority of agraphia rehabilitation models have stressed the second strategy, which implies a cognitive reorganization or reorganization of the functional system.<sup>15</sup>

To reorganize the underlying processes of a writing defect the following is necessary:

a) That the evaluator has sufficient clarity with respect to the altered process and the way in which this interacts in the normal conduct.

b) Ability to formulate precise hypotheses for identifying the altered process and intact processes.

c) That the patient maintains a sufficient cognitive capacity which permits reorganization of a new conduct.

Rehabilitation of writing in aphasic patients should be centered on three fundamental aspects:

1) Comprehension of written language in patients with Wernick aphasia and global aphasia.

2) Agrammatism and difficulties in motor execution in Broca aphasics.

3) Substitutions observed in patients with conduction aphasia.

The techniques of auditory stimulation, such as carrying out instructions or naming objects, are used routinely for reeducation of comprehension to achieve deblocking in patients with global motor aphasia or Broca's aphasia; there may be an attempt to increase automatic production of letters or words.<sup>16</sup>

Luria and Goodglass<sup>17</sup> suggest saying phrases to the patient that contain a subject, verb and predicate, and asking him to write the name of the subject and the action observed. Through this procedure, the patient can acquire a certain competence in writing telegraphic phrases without connectors or grammatical morphemes. In the second stage of treatment, the patient is taught the function of grammatical connectors, such as prepositions, through the use of diagrams and, finally, rehabilitation is directed toward re-education in grammatical morphemes and verb conjugation.

For patients with conduction aphasia, it is necessary to teach a new method of association between graphemes and phonemes. On occasions it is useful to revisualize a word before writing it. The writing of words in automatic form helps to reduce literal paraphasia.

Spatial negligence is unilateral and refers to the incapacity for responding to stimuli presented to the contralateral visual field. For recuperation from spatial agraphia, one suggestion has been the

use of sheets of paper with lines that demarcate the lines and vertical lines that demarcate the spaces between letters and words.

Carlomagno et al.<sup>18</sup> used visual strategies and phoneme-grapheme conversion systems as methods of rehabilitation of agraphia observed in six aphasic patients; all of these had severe writing impairments. Rehabilitation methods were based on the psycholinguistic model and considered two routes of word access:

1) The written naming method, which utilizes visual and semantic keys and stimulates the lexical route.

2) Writing to dictation of words without meaning using phonological keys which increase the use of the phoneme-grapheme conversion technique. Phonological treatment includes: division of dictated words into phonemes, search for correspondence between the dictated phoneme and the phonological key (word which will begin with that phoneme), transfer simple phonemes in their corresponding graphic representations and organize the isolated graphemes within words.

The Russian school of thought describes rehabilitation from a systemic point of view, where according to the altered central mechanism, the defect that underlies the agraphia and the factor is identified, given that there has been identification of different injured zones that can lead to symptoms of agraphia. The essential methodological principle of learning is the utilization of analyzers: visual, kinesthetic and articulatory motor, as aids in rehabilitating the fundamental premises of writing. The creation of an afferent system from intact analyzers positively influences the reestablishment of the disturbed function. In the inverse evolutionary process of function the residual possibilities of the acoustic analyzer must be connected gradually to the activity, in order to progressively normalize the writing function. Special,

systemic learning is needed. The correct organization of this learning depends on the analytical determination of the affected link in the structure of the writing process. The compensatory methods of writing defects are different for the various types of agraphia, given that these are based on diverse psychophysiological mechanisms. It is very difficult to observe the diverse psychophysiological mechanisms. It is very difficult to observe that writing impairments caused by cerebral injuries are persistent, and the occurrence of spontaneous recidivism is rare.<sup>19</sup>

## Conclusions

The cognitive mechanisms that underlie writing are still not completely understood and perhaps for this reason we have not achieved implementation of procedures for sufficiently adequate and effective re-education. Writing rehabilitation continues to be a clinical problem which requires much more clinical study.

The findings pertaining to this type of language impairment are neither conclusive nor determinant.

The attempt to group together the symptoms and signs observed in diverse manifestations of agraphia is a very complex topic, given that the very positions stated in the bibliography sustain, from their point of view, said manifestations.

In rehabilitation, there is a need for methodologies that have an influence on the defect.

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# Clinical epidemiology of hearing disorders

Felipe García Pedroza

Instituto de la Comunicación Humana

Yolanda Peñaloza López

Instituto de la Comunicación Humana

## Resumen

*El objetivo de este artículo es revisar algunos principios y aplicaciones de la epidemiología clínica en la práctica de los médicos que atienden a personas con trastornos de la audición. Después de conceptualizar los términos esenciales, se muestra el paralelismo que tienen la epidemiología y la clínica en la salud individual y colectiva de las poblaciones. Se enlistan, discuten y ejemplifican datos en las áreas específicas donde la epidemiología clínica de los trastornos de la audición puede ser útil en la práctica del personal médico, como: descripción epidemiológica en la comunidad; vigilancia epidemiológica y la aparición de brotes de trastornos de la audición; búsqueda del origen o de factores de riesgo; pruebas de detección o diagnósticas; desarrollo o evaluación de nuevos tratamientos; pronóstico de la evolución clínica de los pacientes, y búsqueda de factores pronósticos de evolución del padecimiento. Los trastornos de la audición, como problema de salud pública en México están en proceso de definición. Hace falta conocer con precisión su epidemiología. En este contexto, la aportación que pueda hacer la práctica de la epidemiología clínica del padecimiento, por parte del personal médico, contribuirá en forma decisiva a su identificación colectiva y a mejorar la calidad de atención médica y de vida del paciente.*

### Palabras clave:

*trastornos auditivos, epidemiología.*

## Abstract

*The objective of the present article is to revise some principles and applications of the clinical epidemiology in the clinical practice of the doctors that assist people with dysfunctions of the audition. After considering the terms, the parallelism of the epidemiology and the clinic method in the individual and collective health of the populations is shown. They are listed, discussed and put on clinical examples in the specific areas where the clinical epidemiology dysfunctions of the audition can be useful in the medical personnel's practice. The areas are: The epidemiology description of the dysfunctions of the audition in the community; the epidemic surveillance and the appearance of "outbreak of dysfunctions of the audition"; search of the etiology or risk factors; detection or diagnostic tests; development and/or evaluation of new treatments; predict of the clinical evolution of people, and search of predictors factors of the evolution of the patients. The dysfunctions of the audition like a problem of public health in Mexico, are in definition process. It is necessary to know its accurate epidemiology. In this context, the contribution that can make the practice of the clinical epidemiology of the suffering, on the part of the medical personnel, will contribute in decisive form to its collective identification, at the same time of improving the quality of medical care and of the patient's life in our country.*

### Key words:

*dysfunctions of the audition, epidemiology.*

## Introduction

The clinical epidemiology of hearing disorders is a very useful tool for the physician who treats human communicative disorders, such as: physicians, medical students, specialists in human communication (audiologists and phoniatriests), otorhinolaryngologists, professionals in communication therapy and nursing personnel. The application of the clinical epidemiology of hearing disorders to patient care will help provide a comprehensive medical treatment, because epidemiology considers the individual with hearing disorders in a wider context (ecological and social) and

not only as another case presenting with auditory difficulty.

The objective of this chapter is to review various principles and applications of the clinical epidemiology of hearing disorders within the practice of physicians who treat people with this condition.

Hearing disorders, from a public health standpoint, are a syndrome whose common denominator is the absence of or deficiency in hearing capacity at various levels in people. This limitation can occur at birth or develop throughout one's lifetime.<sup>1</sup> The prior definition considers hearing disorders to be a

collective health problem that differs from other disorders that are primarily clinical and physiological. Within these disciplines, the study subject can be identified with distinct terms, for example: hypoacusis, deafness, congenital deafness, presbycusis in older persons, hearing impaired, subject with hearing loss, or "hard of hearing," etc.<sup>2</sup>

The practical definition of the clinical epidemiology of hearing disorders is divided into distinct areas: a) it is the study of the distribution and frequency of these disorders within a given population, b) it analyzes the origin and risk factors of the

hearing problem in this population and c) based on the aforementioned factors, it guides and evaluates measures for prevention and control of the disorder.<sup>3</sup>

This definition has some interesting aspects to be highlighted. To begin with, it has parallelism with the scientific method. The first type of study is the description of the studied phenomenon. The greatest difference between epidemiology and clinical investigation is rooted only in the number of subjects studied, given that a clinical investigation studies only one patient or a series of patients with hearing disorders, without taking into consideration the subject's population nor his social and ecological environment. The studies that led to the identification of the human genome were precisely the description of the double helix of DNA. Section b) of the definition corresponds not only to the identification of the causal agents of the illness, but also to the very diverse factors involved with the possible explanation of the distribution and/or frequency of hearing disorders. In this respect, there are multiple examples: both of the agents that originate the illnesses and the risk factors

for populational focus, the discovery of slow viruses in the nervous system or designs for analytical studies. The best examples of this are controlled clinical studies used to contrast the efficacy of new treatments or methods of detection.<sup>4</sup> The last type of study is experimental or interventional within population studies; this is undertaken once it is clinically proved that biological agents or vaccines produce seroconversion in individuals who are susceptible to the respective infectious disease and who receive said substance. Vaccines are a fundamental element of public health programs and have had an immense impact in eliminating the viruses that produced smallpox and almost poliomyelitis throughout the world.<sup>5,6</sup>

The methods of clinical and epidemiological investigation in reality are the scientific method applied to the study of the illness, whether in the individual, through the clinical method, or in the population, through the epidemiological method. Similarities and differences are shown in Table 1. As can be noted in the reference table, the differences, if they in fact exist, are minimal and are determined

based on the particularities that are present during the collection of information, whether clinical or epidemiological; the one cannot be done without the other, or viceversa.<sup>7-9</sup>

The following list includes specific areas where the clinical epidemiology of hearing disorders can be useful in the practice of the personal physician.

1. Epidemiological description within the community.
2. Epidemiological vigilance and the appearance of outbreaks.
3. Search for the origin of risk factors.
4. Tests for detection or diagnosis of people.
5. Development and/or evaluation of new treatments.
6. Prognosis of patients' clinical evolution.
7. Search for predictive factors in patients' evolution.

**Epidemiological description of hearing disorders in the population**

There probably is no doctor who treats patients with hearing problems that hasn't

**Table 1.** The scientific method and individual and collective health

<i>Scientific method</i>	<i>Clinical method</i>	<i>Epidemiological method</i>
Observation	Observation of an individual health problem	Observation of a collective health problem
Problem	Problem diagnosis, examination	Knowledge problem: magnitude, transcendence, vulnerability or other Reference point
Hypothesis and/or objective	Diagnostic hypothesis	Hypothesis and/or study objective
Material and method	Physical examination (observation, palpation, auscultation and percussion)	Collection of information with questionnaires, clinical histories, biological tests, etc.
Analysis, discussion of results and conclusion	Analysis, discussion of clinical history. Diagnostic conclusion	Critical analysis, process, presentation and analysis of information. Conclusion
Decision making	Decision making	Decision making
(5)	(6)	(7)

asked himself, what is the frequency of hearing disorders in the population I treat? To answer this question, it is necessary to know the quantity of people (cases) who have such disorders in a given time period and place, and to carefully identify the at-risk population (incidence). If, instead of new cases, we consider existing cases, then we are discussing prevalence.

To describe hearing disorders in the population, it is necessary to gather distinct variables, such as:

- The number of cases. Parameters that allow the doctor to make a clinical diagnosis. In this respect, the classification of these disorders by the WHO<sup>10</sup> is the resource which allows a balancing of diagnostic criteria with the consequent possibility of comparison with other studies.

- The population of people at risk for illness. This variable is not always accessible to the doctor. National statistics take into consideration the estimated population at the midpoint of the year studied. In the case of doctors who do not treat the national population, this variable could perhaps be defined based on the attendees of the practitioner's medical institution, or also on the visitors to a private practice.

- The time period considered for the study of national statistics was recorded on the last day of June.

- It is necessary to consider geographic location in order for proper consideration of many variables related to hearing

disorders. It is known that ecology is a determinant of many forms of this condition.

- The product of the number of cases, whether new or existing, is multiplied in multiples of 10, until whole numbers are found in the result.

- Indicators define how many cases, and their fractions, exist between the multiples of 10, which are the at-risk population (Figure 1).

Figure 1 reviews the previous concepts.

Once the variables are obtained for calculating the health indicators of hearing disorders 3-a, it is required that these be considered according to the hypothesis and/or objectives targeted in the study protocol.

Here, a frequent form.<sup>3</sup>

- Per person: age, sex, race, occupation, heredity, etc.

- Per location: home, neighborhood, municipality, city, state, region, country, etc.

- Per time period: season, year, five-year interval, decade, etc.

Health indices, or rates, should maintain the same variables, which will permit better comparison with studies

### Figure 1.

*Number of cases*  
-----per 10  
*Population in risk*  
*Time and place*

undertaken in the same population at other times, or in comparison with other populations (Figure 2).

Figure 2 shows how to estimate the rates. If you are trying to determine the incidence of hearing disorders within a given at-risk population, the numerator of the rate will be 2, because only 2 new cases were identified during the study period. If you want to learn the prevalence, then the numerator will be 4, because 2 cases were already known of and during the study period (in this case, one calendar year) 2 more were identified. The magnitude of the rates will be determined based on the size of the at-risk population. The physician may find many examples of the aforementioned within the nation's health statistics published by the Secretaría de Salud (Department of Health).<sup>11,12</sup>

In Mexico, we lack precise population information with respect to magnitude (incidence and prevalence), whether in the entire territory or by federal entity, with respect to hearing disorders.<sup>13</sup> The forthcoming section presents the most notable results of the universal detection program for hearing disorders among newborns of the state of Colorado, in the United States.<sup>14</sup> Background: in 1992, four hospitals voluntarily initiated a program to locate patients with hearing disorders from within their overall patient population. By 1996, 26 hospitals were administering detection tests in all newborns at those institutions.

## Results

In 1999, legislation in the state of Colorado made detection of hearing disorders obligatory in 100% of newborn children of the area.

During 1999, in 60 hospital maternity wards, 63,590 newborns were studied.

Only 263 parents of recently born children declined to participate in the detection program; the non-participation rate was 0.4%.



Figure 2. New and existent cases of hearing disorders.

87% of the participating children were studied before hospital discharge (55,324).

A total of 86 newborn children were identified with congenital hearing disorders; with an incidence rate of 1.35 per 1,000 studied.

One of 643 live-born children was detected with hearing disorders.

#### **Type of hearing disorder**

Bilateral sensory 59, 68.6%

Unilateral sensory 17, 19.8%

Bilateral conductive 4, 4.7%

Unilateral conductive 6, 7%

Total 86, 100%

#### **Level of hearing loss**

Medium 6, 7%

Moderate 42, 48.8%

Severe 33, 38.4%

Profound 5, 5.8%

Total 86, 100%

37.2% of the children with detected hearing disorders had one or more of the risk factors (32/86).

Children's age at time of diagnosis

50% 2.1 months of age

71% 3 months of age

92% 5 months of age

## **Conclusion**

This universal detection program for congenital deafness showed itself to be a viable program in a large state and/or region, when this was determined by a legal mandate.<sup>14</sup>

### **Epidemiological monitoring of hearing disorders**

Epidemiological monitoring of hearing disorders consists of continual analysis of the condition and follow-up of the evolution of episodes or conditions that are positively modified within a given population, time and place. The objective is to evaluate the preventive and control measures that have been applied to the problem.

The study of outbreaks, understood as the unexpected appearance of new cases of an illness in a given population

(generally transmissible), is practically limited to infectious illnesses. In the case of hearing disorders, there is participation in those cases when the origin of disease is infectious.

For the aforementioned reasons, the fundamental objective of epidemiological monitoring is to provide reliable and timely information relating to the evolution of the health problem and the result of the pertinent actions of the corresponding program. The best example of this can be noted in the existence of acute respiratory syndrome in various countries and the absence of cases in Mexico. Thanks to epidemiological monitoring measures, the condition did not spread to more countries.

There should be parallelism between epidemiological monitoring systems and the implementation of hearing-disorders programs. Based on follow-up of determined variables, there can be objective evaluation of achieved progress and detected problems. The principal benefit of such a system is to guide necessary adjustments within the health program for hearing disorders.

The characteristics of the monitoring system should reflect the conditions where the hearing-disorders program is undertaken.

When possible, program professionals should undertake studies of cases of this disorder that seek to identify its possible cause. With knowledge of new cases in a community, it is also possible to determine preventive measures when epidemiological monitoring takes place.

The results of an epidemiological monitoring system of hearing disorders should be presented in an accessible format and on a periodic basis, and should be discussed with the groups who have participated directly in their determination and with the people who will participate on a short-term basis. It is necessary to periodically evaluate the experiences and ensure that their conclusions are incorporated into the

planning process of the possible program for hearing disorders.<sup>13</sup>

Outbreaks are the appearance of an unusual number of cases of an illness with relation to the three variables mentioned previously,<sup>3</sup> which are generally related with transmissible conditions.<sup>5</sup>

As an example, we could cite the epidemiological monitoring in our country of measles. Specialized publications report on new cases, both those of the Secretaría de Salud and international publications.<sup>12,6</sup> The practical application of epidemiological monitoring of rubeola can be found among the children of Goteborg, Sweden, where epidemiological follow-up allowed an evaluation of its impact in the evolution of congenital deafness; there, the prevalence fell from 3.8 to 2.0/1,000 from 1970-74 to 1980-84, thanks to the efficacy of immunization programs for rubeola and parotitis.<sup>15</sup>

In Mexico, congenital deafness is in the process of being defined as a public health problem. Promotion, execution and evaluation of epidemiological studies that include follow-up is still needed.<sup>1</sup>

### **Search for the origins or risk factors of hearing disorders**

For the physician, the necessary question is: after making a diagnosis and becoming aware of the outbreak, what was the outcome of the hearing disorder? The clinical experience of physicians is nothing more than epidemiology and consists of: medical training, experience in collecting and analyzing patient record information, patient laboratory and/or office examinations, and the process of making two types of determinations. The causal agent is identifiable through the patient's clinical information, where it is possible that the mother had rubeola during pregnancy; in the absence of other data, only perinatal antecedents are identified, such as encephalytic cranial trauma, or encephalitis. In the

case of rubeola during pregnancy, we are discussing the origin of hearing disorders at birth; when we discuss perinatal antecedents we are discussing risk factors for hearing disorders. Case and control studies are the obligatory tool for identifying the cause or risk factors of hearing disorders.

Cohort studies are an important form of clinical/epidemiological research used to test hypotheses relating to the causes of illness. Generally, cases are compared with controls to compare characteristics related to causes or risk factors (Figure 3). The bibliography is ample, here we refer to a section that we had access to.<sup>16-23</sup>

The distinctive characteristics of cohort studies are:

1. That the group or groups of people to be studied in cohort are defined in terms of the characteristics they manifest before the appearance of the illness investigated. (Table 2).

2. That the study groups (so defined) are observed during a certain time period to determine the frequency of the illness.<sup>19</sup>

There should be consideration of the distinction between retrospective and prospective cohort studies. This difference depends on whether or not cases of the illness have occurred within the cohort as of the beginning date of the study. In a retrospective cohort study, all pertinent occurrences (causes and effects) have already taken place by the beginning of the study. In a prospective

study, the pertinent causes may or may not have occurred by the time the study begins, but the cases of the illness still have not developed and, after cohort selection, the physician must wait for the condition to appear among participants. The difference between these two processes is important, not because the concepts of interpretation are distinct, but because it concerns some practical points that are reviewed in Table 3.

Cohort studies have advantages and disadvantages that can be noted in Table 4.

### Diagnostic or detection tests for hearing disorders

The objective of detection tests is acquisition of objective results that confirm the clinical diagnosis. These tests are a filter of people who may have hearing disorders in a given at-risk population. To rule out false positives, the test is applied through a clinical examination and determines the relationship of cases within the analyzed population. Studies of sensitivity, specificity and predictive value are the instruments used to validate detection and/or diagnostic tests of hearing disorders.

The process of test validation generally consists of the following stages, which should be sequential:

a. Accessibility and appearance of the questionnaire. Questions should be understandable, not only in Spanish, and should include idioms used and understood by the people interviewed.

It is essential that the questionnaire be accessible and viewable (that it not be heavily loaded with ink, nor too lengthy) and that it be pre-coded for later statistical analysis.

b. Criterion (test of sensitivity, specificity and predictive value). Each question should be tested against a gold standard (see below).

c. Construct validity. Select the questions with the most sensitivity, specificity and predictive value to form the final questionnaire. The validity of the construct is determined in known conditions, where the physician knows in advance who has the illness and who does not; this process takes place before the principal investigation.

d. The practice of clinical medicine is the application of the scientific method, as can be seen in Table 1.<sup>7-9</sup> The process of clinical reasoning, for medical decision making, is often very complex. One argument in this respect is made by those who consider medicine to be an art. Furthermore, there is the “clinical eye,” which – if it does in fact exist – has not been reproduced in medical schools. Instead of the clinical eye, those who train professionals seek to develop the clinical reasoning abilities of their students. This is based on the diagnostic probabilities made available through the experience the physician has acquired through the practice of his discipline within a determined space (place, time and at-risk population).

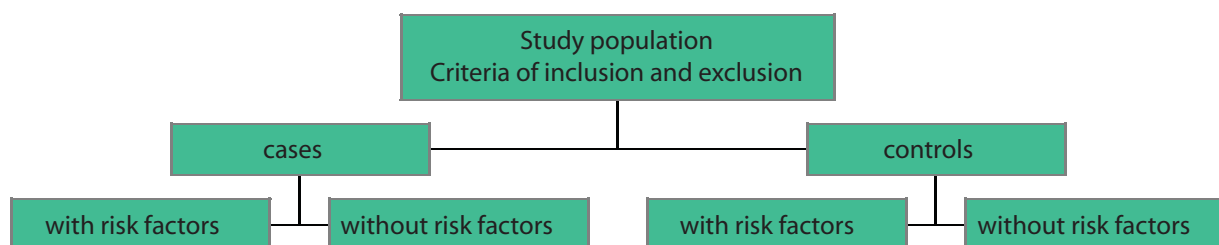


Figure 3. Diagram of cohort studies.

**Table 2.** Selection of individuals for study cohorts

- a. That some of the previous causes are added within a particular group of individuals.
- b. That the individuals have suffered some unusual experience or risk exposure, which has been deemed appropriate for evaluation.
- c. That the individuals offer some special resource that allows for discovery of the circumstances of his risk exposure, or observation of the course and consequences of the illness.
- d. That it is desirable to undertake the cohort study in this particular group, given that the group seems as favorable as any other group.

**Table 3.** Quality of clinical information from retrospective and prospective studies

<i>Variable</i>	<i>Retrospective</i>	<i>Prospective</i>
Information	Less complete and precise	More complete and precise
Discontinuous exposure	Useful	Not useful
New exposures	Not useful	Useful
Cost	Less costly	More costly
Study time	Shorter	More prolonged

**Table 4.** Advantages and disadvantages of cohort studies

<i>Advantages</i>	<i>Disadvantages</i>
Direct calculation of relative risk	Often require a large sample size
Can provide information relating to the incidence of the illness	Often require a large sample size, consumes more time
Temporal relationship between exposure and illness	Often require a large sample size, could seem more costly
Efficient, particularly for the study of infrequent exposures	They are not practical for the study of infrequent illnesses
Can generate information relating to multiple exposures	Rate of non-cooperation of the cohort participants can negatively affect the validity of the results
Can provide information relating to the multiple results of a particular exposure	Changes in methods of diagnosis and classification can lead to biased results
Reduce bias	
Strong observational design to establish cause and effect relationship	

Diagnostic tests are tools that support or objectify the clinical suspicions pertaining to the condition. An example of this would be serum testing to identify specific antibodies to toxoplasmosis in the pregnant mother or in the child at birth, as a cause of deafness. As with many others, these tests try to identify the probability that an infectious agent is the cause of the condition, as opposed to other possibilities with equal prevalence in our field, such as rubeola and others.

Diagnostic studies and tests can be performed for various reasons: a) to determine the probable origin of an illness, b) to evaluate the severity of a condition, c) to anticipate the prognosis of a study, d) to evaluate the response to a treatment and e) accessibility of tests for the detection of various illnesses in population studies.<sup>2,24</sup>

Diagnostic studies or tests should estimate sensitivity, specificity and predictive value. Sensitivity is defined

as the percentage of individuals with a positive result in the study test and who truly have the characteristic identified by the mentioned test. Specificity, the inverse of sensitivity, refers to the percentage of individuals who have a negative result in the same test (Figure 4).<sup>2,24</sup>

Sensitivity and specificity are parameters that describe the exactitude of a study. Two measurements relating to the calculation of the probabilities

of whether or not an illness exists are positive and negative predictive value. The first is defined as the percentage of people with a positive result in the diagnostic study or test, and identifies the people who really have the illness under investigation. The second is defined as the percentage of people with a negative result in the diagnostic test or study, and identifies the people who do not have the illness. (Figure 4).

Perfect diagnostic studies or tests would be those with 100% sensitivity, specificity, and positive and negative predictive value: such studies do not exist. Instead, there are tests that offer distinct probabilities, which are expressed in percentages.<sup>24</sup>

The following example attempts to demonstrate the application of the previous concepts:

In this investigation, a model of a binaural fusion test was developed, in Spanish. The accuracy percentages obtained from 40 subjects with normal hearing, and without psychiatric or neurological illness, were compared with those obtained in 22 cases with temporal lobe injuries and 13 cases with multiple sclerosis. The difference between both groups (normal/nervous system damage) in the binaural fusion

tests (which determine alterations when there is involvement of the central auditory function) was significant for chi square ( $p < 0.005$ ) in those with temporal lobe injuries and multiple sclerosis. In the article there is a discussion of the differences found between this binaural fusion model and the classic model of Willeford.<sup>25</sup>

### Development and/or evaluation of new treatments for hearing disorders

Drug treatments for various illnesses and symptoms (which prevent and control hearing disorders), such as those linked to otitis media by reports in textbooks and specialized journals, are the result of controlled, randomized clinical studies, or clinical trials. The physician who uses this type of information must understand, in principle, how these studies are designed and evaluated before such treatments are approved for generalized application in patients with hearing disorders. However, with appropriate knowledge and experience, this physician may also undertake clinical studies of new treatments.

As physicians, we apply two types of experiences when evaluating a

treatment: personal experience (or that described by our colleagues), and written experience, which could be described in a case report, a case series or in a comparison of one treatment with another.

The objective of clinical studies is to provide information that assists in the selection of and appropriate, effective use of treatments.<sup>26</sup>

There are multiple clinical study themes, and these are determined by many variables; however, the physician acts as the “sensor” who must determine the “what” and “how” of a study of hearing disorders. Table 5 reviews some relevant points.

### Evidence-based medicine

Evidence-based medicine is a compilation of the best available decisions derived from the clinical experience, available physiopathological knowledge, and the preference of patients. All of these factors form the basis for making healthcare decisions. The principal reasons for using evidence-based medicine are:

a. It could constitute an effective reference point for access to the medical literature and systemic interpretation of the literature.

b. It could provide an objective basis for choosing a strategy for treatment of the illness, through which the result will be improved.

c. It could serve as an objective basis for maintaining the physician’s relevant treatment practices up-to-date.

**Figure 4.** Estimation of sensitivity, specificity, and positive and negative predictive value.

Study	“Gold standard” Study	
	With illness	Without illness
Positive	a True positive	b False positive
Negative	c False negative	d True negative

Sensitivity = True positives

$$\text{True positives} + \text{false negatives} \times 100 = a/a + c \times 100$$

Specificity = True negatives

$$\text{True negatives} + \text{false positives} \times 100 = d/d + b \times 100$$

Positive predictive value = True positives

$$\text{True positives} + \text{false positives} \times 100 = a/a + b \times 100$$

Negative predictive value = True negatives

$$\text{True negatives} + \text{false negatives} \times 100 = d/d + c \times 100$$

d. It could offer a coordinated plan for treatment of the illness, given that a multidisciplinary team provides care to a single patient.

e. It could permit the identification of little-known areas within the current medical knowledge, and thus recommend complementary studies in the treatment of the illness.

f. It could indicate those areas where flexibility is justified in the treatment of the illness, based on the lack of evidence to support a particular treatment.

g. It could facilitate the evaluation of the treatment process, suggesting opportunities to improve the quality and effectiveness of the medical treatment.<sup>16</sup>

### **What should be investigated with respect to the development and/or evaluation of new treatments for hearing disorders?**

The first step in a clinical study is to formulate the principal theme of investigation.

The theme should be found in Table 1, where, based on an observation of a specific area of knowledge, a problem is identified. The development, justification and proof of both the observation and the knowledge-related problem should be based on the clinical experience of the physician and supported by data available in Internet or online information sources.

Once the study subject is identified, it is essential that this be recorded, and that a hypothesis be elaborated: third step of the scientific method (Table 1).<sup>8</sup>

The hypothesis is the response to the presentation of the problem as derived through the developed knowledge. The greater the level of precision in the response to the presented problem, the greater will be the contribution to the body of knowledge under investigation. Based on the hypothesis, various elements should be taken into consideration, such as: type of variables to be compared, the

number of subjects in each group, the study's inclusion criteria, etc.

The most important parameter, or parameters, is the response that answers the knowledge-related problem expressed in the presentation of the problem (Table 1), which the hypothesis seeks to resolve. In the determination of the parameter, the physician must consider the response to the following questions: a) what is the most important response to the presented problem?, b) which of the possible responses can be measured objectively and without bias?, c) which facilities or restrictions exist in the design of the study (material and method) to test the hypothesis? Various aspects can be mentioned with respect to this point: sample size (number of patients and controls required), real availability of laboratory and office studies for the study of the patients and their possible controls, etc.

The development and/or evaluation of new treatments can be performed based on the knowledge problems that need to be resolved (Table 5).

As the readers will note, the hypothesis will be a fundamental component of a clinical study that is employed as a means for generating new scientific knowledge. From a practical point of view, the hypothesis has two variables: one is independent, and determines the studied phenomenon, and the other is dependent, with an existence and/or evolution that depends upon the independent variable. An easy-to-understand example of this is the effect produced by the application of heat to a container of water. We know that the longer heat is applied, the more the container will heat up, with the potential of reaching 100 degrees centigrade (boiling point) and boiling. In this experiment, the independent variable is the heat and/or time that heat is applied to the container, and the dependent variable is the resulting water temperature.

Another procedure for formulating the hypothesis is through the null and alternative hypotheses.

With the null hypothesis there is no difference in the curing rates or percentages between treatments 1 and 2.

Null hypothesis: treatment 1 = treatment 2.

The alternative hypothesis is complementary to the null hypothesis, that is, if there is no difference between treatment 1 and 2 (null hypothesis), then it is better than the other hypothesis (alternative hypothesis).

Alternative hypothesis: treatment 1  $\neq$  treatment 2.

The difference in the efficacy of the treatments is determined through various statistical tests designed to verify that they are not random, that is, that they are true.

### **Determination of the number of individuals participating in the clinical study of hearing disorders**

The determination of the number of people participating in the study is of utmost importance. Many aspects are involved in the determination of the study population, such as: study objective, sufficient number of cases of the illness, diagnostic cost of each one, procurement of informed consent of all participants, etc.

The dilemma is in studying the sufficient minimum of patients, which, once the study is concluded, allows the researcher to uphold of the possible conclusions. There is considerable medical literature devoted to the design of controlled studies. Guidance with respect to the number of individuals involved is generally provided in articles published on the theme.

Medical researchers, as practitioners of a scientific discipline, are aware of the possibility of committing errors that affect the study conclusion. Two error



types are identified: I y II. These can occur in the following manners.

Suppose that treatment 1 is the most accepted treatment for condition X, and that treatment 2 is in the process of accumulating encouraging results. Through a controlled clinical study, it is necessary to determine if both are equal (Table 6).

If, during the study, a difference is found between the two treatments, when in fact there is no difference (box B), a type I error has occurred. In this circumstance, the results are false positives. If no difference is found between the treatments, when in reality there is a difference, (box C) a type II error has occurred: in this case the results are false negatives (Table 6).

The most common causes for type I and II errors are inadequate design of the clinical studies and chance, or both. Although type I and II errors can be minimized with careful study design, those errors owing to chance can never be eliminated completely, but can be estimated. The symbology used denotes the probability of a type I error; the

difference observed between the groups is not true but is caused by chance and is named alpha level. To the contrary, the name used to describe the probability of a type II error is applied to the cases in which the study did not find a difference, when in reality there is a difference, and this is called beta level.

Medical researchers should determine the alpha and beta levels when they plan the study. It is common that the alpha level is specified with a value of 0.05, which indicates that the researcher is willing to accept a 5% risk of type I error (falsely conclude that the study groups differ when in reality it is not true). Furthermore, the researcher should specify beforehand the beta level or the risk of a type II error. Generally, a value of 0.20 is accepted as sufficient. This indicates that the researcher accepts a 1 in 5 chance of missing a true difference between study groups.

Statistical power is another highly important variable in the design and conclusions of a clinical study. Its definition denotes the capacity of a study to detect a true difference between the

comparison of the study groups, and is obtained subtracting the value of the beta level from the unit (one) and multiplying it by 100 ( $1 - 0.20 = 0.8 \times 100 = 80\%$ ). Therefore, the study would have a probability of 80% of detecting a specific difference in the result between the groups.

**Random assignment of patients in the clinical study of hearing disorders**

The principal dogma of clinical studies is that patients should be assigned to distinct treatment groups through a method that guarantees the maximum probability that they will have the highest degree of similarity, with respect to the basic characteristics of the illness that is being investigated, characteristics which can influence the response to the treatment being tested.

To reduce the possible preferences of the physician and the patients, assignment to study and/or treatment groups is randomized. In this manner, the determination of the groups is based on mathematical probability

**Table 5.** Problems to be resolved through clinical studies of hearing disorders

Response to problems	Example
Quality of medical care	Certain diagnosis
Quality of life	Eradication and/or control of some causes of hearing disorders (rubeola, parotitis, etc.)
Predictions	Predict evolution of hearing disorders, for example, cochlear implants.
Other	

**Table 6.** Possible types of errors in clinical studies

Results Treatment 2	Results Positive	Treatment 1 Negative
Positive	A. Correct (true positive)	B. Type I error (false positive)
Negative	C. Type II error (false negative)	D. Correct (true negative)

instead of the possible preferences of people involved in the investigation. There are many procedures for random assignment of patients in study groups. In one of them, all the patients who meet the inclusion criteria are numbered progressively as they are recruited to the study; systematically, the last two patient numbers are sought in the tables randomly, whether from below to above or in the inverse direction (transverse or oblique, etc.), and as the patient numbers intersect with the numbers of the selected columns, numbers are assigned to each patient group.<sup>27</sup>

### **Ethical considerations of clinical studies of hearing disorders**

There are various ethical aspects involved with the undertaking of clinical studies.

The first is expressed through the following question: is the randomized study an ethically acceptable method? One of the most important ethical dogmas in medicine is that the patient's well being is the top priority and the physician must prescribe the optimum treatment.

Currently, the clinical study is considered the best available method for determining the benefits and, in such cases, the possible harmful effects of treatments.

If the physician accepts that the clinical study method is appropriate, then the study's application and methods for proper ethics should be decided upon. The following section includes a list of suggestions or guidelines for medical professionals who currently direct clinical studies:

1. Based on previous studies, it should be known that none of the treatment options included in a randomized clinical study is inferior to the others; if there is a frequent or known treatment, or a treatment validated through empirical experience, it is necessary to use this as a control.

2. The study should focus on a clinically important theme and search for a response to the knowledge gaps in the treatment of illnesses, in such a way that the results of the clinical investigation are useful for future patients.

3. It will be explained to the patients that they are taking part in a clinical study and they will be informed in plain language of the treatment options, risks and random nature of the distribution. If the patient agrees to participate, it is understood that he has provided his informed consent, which implies that he has freely chosen to be included in the study. All health services that perform clinical investigation operate under the guidelines of the Ley General de Salud (General Health Law) and its various ordinances, for which reason there are strict regulations that the investigating physician must adhere to.

4. To initiate the study, the clinical investigation groups should consider the protocol design, which will reasonably include a sufficient number of patients and controls to permit protocol development.

### **Evaluation of controlled clinical studies of hearing disorders**

There is a paradox in the practice of medicine between prevention, assistance and rehabilitation of illnesses. Patient assistance is the most commonly exercised activity by physicians, however, a relatively small number of physicians actually design, perform and evaluate clinical studies. Study participation by patients with various illnesses is limited, therefore, it is often the case that care for hundreds or thousands of people with hearing disorders is determined by such studies and a limited number of patients. Table 7 proposes a guide for physicians with a list of questions and responses that can guide the physician in determining the validity of the study results before considering them in the treatment of their patients.<sup>16</sup>

As an example, we consider the study based on the problem of needing to define appropriate rehabilitation strategies for children with dyslexia (n:40), in whom there was an estimation of the percentage of abnormalities in the auditory cerebral lateralization with a new test using digits in Spanish, compared with 40 children who did not show abnormalities in reading and writing. After identification of 37% of dyslexic children with abnormalities in the auditory lateralization, a recommendation was issued for evaluation of this function with the goal of providing precise orientation within their rehabilitation program.<sup>28</sup>

### **Prediction of clinical evolution in people with hearing disorders**

Patient prognoses are generally based on the experience of the attending physician, complemented with the review of large series of patients through specific meta-analyses.

### **Search for predictive factors in the evolution of patients with hearing disorders**

The analysis of factors that lead to a positive prediction of the clinical evolution of patients with hearing disorders is the counterpart to the risk factors that explain illnesses. These factors are obtained in the same way as the previous point, through the experience of the attending physician complemented by analyses of large series of patients with the same diagnosis, online reviews or meta-analyses.

### **Hearing disorders as a public health problem**

The health-illness process is the result of: homeostasis of the individual, interaction between human beings, and the interaction of human beings with their environment. It is in this context that social organization is justifiable, not only to offer guidelines for the social coexistence of humans, within nations,

**Table 7.** Guide to evaluate the results of clinical studies

1. Is the clinical observation mentioned?
2. Is the knowledge problem understood, with respect to the medical treatment?
3. Does the study offer a clear objective or hypothesis?
4. Are the independent and dependent variables identified with precision?
5. What was the null hypothesis?
6. Were the objectives and/or hypothesis achieved or proved?
7. What was the result of interest?
  - What was a significant difference in the result?
8. Which group was analyzed?
  - How was the studied population formed?
  - What were the explicit inclusion and exclusion criteria?
  - Assignment of cases and controls, random and other (voluntary, cumulative, etc.)
  - What were the demographic and health characteristics of the groups?
9. How many subjects participated in the study?
  - What size was decided upon before study initiation?
  - What was the number of patients and controls that completed the study?
  - What were the causes for non-participation of 100% of the sample size and/or studied population?
10. How were the experimental and control groups selected?
  - During the formation of the study groups, was there assurance of an equal distribution of known risk factors?
11. Were the treatment regimens adequately described?
  - If appropriate, was there an untreated group?
  - If the control is the known therapy, was the treatment reasonable?
12. Was this a blind study?
  - Did the patients know which treatment they were receiving?
  - Did the physicians know which treatment the patients were receiving?
  - Did the individuals who measured the results know if the patients were in the control group or the experimental group?
13. What were the results?
  - Were the treatment groups similar with respect to known predictive factors?
  - Were the side effects registered and reported?
  - Who was included in the final results?
  - Who was lost during follow-up? Were they different from participants that completed the study?
  - During the analysis, did the patients remain in their originally assigned groups?
  - Was the presented data sufficient, in that the conclusions can be justified?
  - In the analysis, were the known risk factors described?
  - Were confidence intervals reported?
  - If the results were negative, was the statistical power recorded?
14. Were the results biologically plausible and consistent with previous medical reports?
  - If not, was this data recorded?
15. What was the real contribution of this study to overall knowledge?
16. What is the conclusion of the reviewed study?

but also to seek the comprehensive well-being of individuals.

Each country has a distinct historical approach to addressing its health problems. Ideally, health authorities should orient their efforts toward the

prevention and control of the majority of the illnesses affecting their populations. However, in Latin America, the demand for services is always higher than the supply. This circumstance is attributable to the fact that, among other factors,

the illnesses within a population and the availability of health services tend to be closely connected to a country's level of socioeconomic and cultural development. The assignment of health resources to attend to these problems is

usually determined by health officials who generally address the population's most urgent needs (based on their own perceptions of public health), before addressing those problems that are less understood or less prevalent.

The impact of hearing disorders as a public health problem is not only reflected in the prevalence rate, which we assume to be high in our field, but also causes a decline in the quality of life of the patient, who cannot establish effective communication in his or her social life.

Professionals who work in fields relating to hearing disorders seek to generate an organized response from society in order to help prevent and control the illness. Once a program is created that addresses the illness as a public health problem, these professionals should attempt to call the society's attention to the illness, with the intention of developing an auditory health program to treat this group of patients.

So that hearing disorders may be included in regular public health programs in countries like Mexico, it is necessary that the parameters for identifying such disorders as public health problems be widely recognized. To achieve this end, it is necessary to undertake clinical-epidemiological studies within our country, even if these appear to be costly. Within this context, clinical studies of hearing disorders will contribute decisively not only to improving medical care for each of our patients, but also will complement their clinical-epidemiological profile in the area or region where the studies are undertaken.

## Conclusion

The argument for giving consideration to hearing disorders as a public health problem in Mexico, and in other Latin American countries, is still being developed. We still lack a precise understanding of the magnitude of these

disorders (incidence and prevalence) and their transcendence (or in other words, the costs that these imply for the patient, the patient's family, and society as a whole). It is also necessary to acquire greater experience in the prevention and medical control of hearing disorders to facilitate the support of the patient's social development. Within this context, the contribution that clinical epidemiology can make in treating this condition will be a decisive factor in improving the quality of life of the patient in our practice.

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