

Evaluation of extralaryngeal diameters in senile individuals

Rafał Zieliński, Kazimierz S. Jędrzejewski

Department of Anatomy, Medical University of Łódź, Poland

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The aim of the study was a morphometrical macroscopic evaluation of extralaryngeal diameters in elderly people, according to its usefulness in ORL diagnostic and operational methods.

Laryngeal preparations together with surrounding structures were taken from cadavers of both sexes, aged 65 and over, about 24 hours after death. Clinically important extralaryngeal diameters were collected using common morphometrical methods. A few body features were also gathered. Computer statistical methods were used in data assessment including basic statistics and linear correlations between diameters, and between diameters and body features.

The data presented in the study may be very helpful in diagnostic methods' evaluation. They may also help in: selection of the appropriate operational tool size, choice of the most appropriate operational technique, preoperative preparations and designing and building virtual models for physicians' training.

key words: morphometry, anatomy, otorhinolaryngology, extralaryngeal diameters, age, senile

INTRODUCTION

Most European societies (including Poland) can be described as ageing ones. The latest sociological data demonstrate that society ageing is not over yet, and the process concerns men and women, rural and urban residents. Simultaneously the number of elderly people, biological differences of an old person and diagnostic and treatment difficulties make senility a great sociological and clinical issue. According to Żakowska, elderly age starts at 65 [7]. A strong correlation is known between the presence of malignant tumours (especially epiglottis carcinomas) and senile age [1]. This makes precise knowledge of the anatomy of the larynx and its surrounding structures a very important subject in the population [6]. Many operational and diagnostic ORL procedures in these cases concern extralaryngeal structures (incl. trache-

otomy, tracheostomy, partial and total laryngectomies etc, carcinoma infiltration evaluation with visual diagnostic methods). Thus, obtaining morphometrical data concerning the anatomical surroundings of the ageing larynx would be very important from both the clinical and the cognitive point of view. Few authors put a morphometrical study on the larynx beyond their interests but these researches have been carried out only on muscle- and ligament-less and/or fixed larynges [3]. The studies were not especially interested in the elderly population. Clinically important extralaryngeal measures were not taken in any age group, including senile patients [5].

Thus the aims of this study were:

- the acquisition and presentation of macroscopic morphometrical data concerning clinically important extralaryngeal measurements;

- A statistical evaluation of the data in order to find qualitative correlations between extralaryngeal diameters, and between extralaryngeal diameters and body features.
- A proposal for the practical use of morphometrical data on the basis of the author's research and bibliography study.

During the collection of the data it was necessary to use abbreviations. The list of the abbreviated names of diameters collected during the gathering of measurements is listed below.

- H distance between peak of superior thyroid incisure and lower margin of hyoid bone shaft
- T0 distance between apex of superior thyroid incisure and middle of first annular ligament (median line)
- T1 distance between apex of superior thyroid incisure and middle of second annular ligament (median line)
- T2 distance between apex of superior thyroid incisure and middle of third annular ligament (median line)
- TAR height of thyroid gland isthmus (median line)
- TY-TAR distance between apex of superior thyroid incisure and lower margin of thyroid gland isthmus (median line)

MATERIAL AND METHODS

Data presented in the study were collected in 1998–2000. 52 laryngeal preparations were gathered from cadavers of both sexes, including 28 preparations from men (age: 65–87, mean: 71.7), and 24 preparations from women (age: 65–81, mean 69). Larynges with surrounding tissues excised out of persons with any possibilities of structure damage according to diseases, diagnostic or surgical manipulations were not taken into consideration. Larynges were cut out of the bodies together with surrounding tissues and organs (cervical part of oesophagus, cervical part of trachea, thyroid gland and hyoid bone). The preparations were taken out of the cadavers as soon as possible, in accordance with Polish legal requirements (approximately 24 hours after death). In order to avoid any fixation deformities, they were not fixed in any way with any morphological method. This kind of morphometrical preparation was similar to that proposed by Sprinzl and Eckel [5]. Personal attributes were noticed during autopsies, such as: age, sex, height of body, colum circumference (laryngeal prominence level), and

nourishment type, which was described in a simple statistical way: 1) hypotrophic, 2) normotrophic, and 3) hypertrophic. Diameters were divided into groups according to ease of access during assessment and cervical diagnostic and operational procedures. The population was divided into two sex groups. A micrometer and Vernier calliper were used during morphometric assessment. The diameters are shown in pictures below (Fig. 1 and 2). Data were charted and put to statistical evaluation, including: basic statistical evaluation and finding important and strong linear correlations between variables describing both: body features and extralaryngeal diameters. Linear character of correlation was proven in cases with similar or identical Pearson and Spearman correlation indices [4].

RESULTS

Results of basic statistical computations are presented in tables below (Tables 1–6).

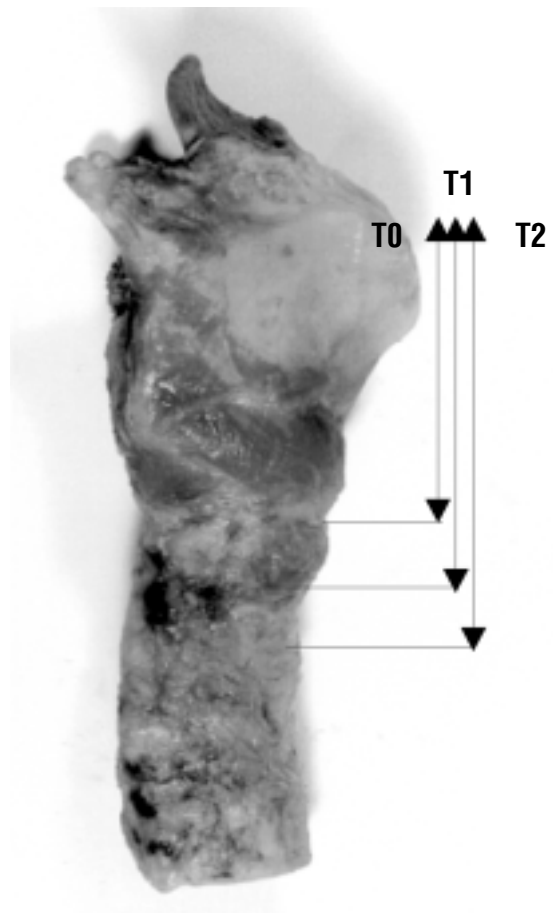


Figure 1. Extralaryngeal diameters, lateral view.

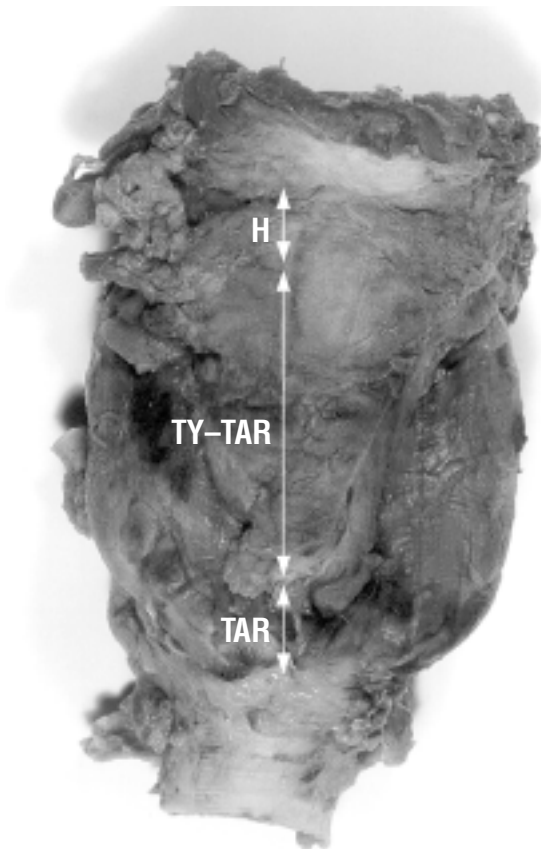


Figure 2. Extralaryngeal diameters, anterior view.

Table 1. Men, body features

	Mean value	Median value	Minimum value	Maximum value	Std dev.
Age	71.6786	70.5	65	87	6.64471
Height	172.714	172	164	182	6.67143
Nourishment	2.21429	2	1	3	0.56811
Collum circumference	41.2143	42	34	44	3.15474

Table 2. Women, body features

	Mean value	Median value	Minimum value	Maximum value	Std dev.
Age	69.6364	67	65	81	5.42082
Height	160.727	160	157	166	2.99495
Nourishment	2.18182	2	1	3	0.58849
Collum circumference	37.6364	38	34	43	2.62851

Table 3. Men, diameters: H, T0, T1, T2

	Mean value	Median value	Minimum value	Maximum value	Std dev.
H	1.60857	1.61	1.11	2.27	0.30309
T0	4.23286	4.24	3.8	4.61	0.25247
T1	4.84643	4.95	4.1	5.31	0.38007
T2	5.39429	5.585	4.5	6	0.46248

Table 4. Women, diameters: H, T0, T1, T2

	Mean value	Median value	Minimum value	Maximum value	Std dev.
H	1.70455	1.54	1.25	3.12	0.51615
T0	3.41091	3.45	3.08	3.7	0.19758
T1	3.92636	3.9	3.5	4.6	0.31373
T2	4.36364	4.22	3.94	5.25	0.3756

Table 5. Men, diameters: TY-TAR, TAR

	Mean value	Median value	Minimum value	Maximum value	Std dev.
TY-TAR	3.006429	3.17	1.12	4.25	0.874686
TAR	2.505	2.44	1.15	3.75	0.80791

Table 6. Women, diameters: TY-TAR, TAR

	Mean value	Median value	Minimum value	Maximum value	Std dev.
TY-TAR	2.54091	2.5	1.61	3.47	0.63533
TAR	2.98091	2.71	1.6	5.43	1.23129

Age is presented in years, nourishment type is listed on a 3-point scale, other measurements are presented in centimetres.

In the male population, proven linear strong correlations were observed in pairs of variables (Pearson indices are listed in brackets): nourishment type and T1 (-0.79), nourishment type and T2 (-0.81), T1 and T0 (0.60), T1 and TAR (0.38), T2 and TAR (0.39).

In women, a strong linear correlation, important from the clinical and cognitive point of view, was found between variables describing the height and position of thyroid gland isthmus [TAR and TY-TAR (-0.67)].

DISCUSSION

Extralaryngeal diameters, important in ORL practice, were not evaluated before, in any available literature, in patients of any age, including old people.

Preliminary evaluation of data proved the proper division of preparations into groups of male and female specimens. Morphometrical differences are significant and emphasise sexual dimorphism in the morphometry of extralaryngeal diameters. In many cases differentiations in diameters were small or very small, according to standard deviation values and mean values. Unfortunately few diameters (TAR, TY-TAR, in the male population and TAR, TY-TAR, H, T2 in the female population) demonstrated high differentiation, which makes the mean value in these variables useless in practice. The data may be very useful in ORL operational preparation (including common procedures, such as: conicotomy, tracheotomy, tracheostomy, total laryngectomy, partial laryngectomies, laryngeal microsurgery procedures, thyroid gland operations) and evaluation of diagnostic technique results, including X-ray scan, CT and NMR scan evaluation of surrounding larynx structures. Linear correlations found between variables describing diameters, and body features and diameters may be very useful in diagnostic method evaluation, helping in right tool size selection, the most appropriate operational technique choice and preoperative

preparations in elderly people. The data may also be very helpful in the near future in designing and building ORL virtual models for diagnostic and operational training [2].

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REFERENCES

1. Burch P (1984) Cancer and senescence: is there a biological link? *Acta Genet Med Gemellol Roma*, 33: 457-465.
2. Fried MP, Moharir VM, Shinmoto H, Alyassin AM, Lorenzen WE, Hsu L, and Kikinis R (1999) Virtual laryngoscopy, *Ann Otol Rhinol Laryngol*, 108: 221-226.
3. Hirano M, Kurita S, Yukizane K, and Hibi S (1989) Asymmetry of the laryngeal framework: a morphologic study of cadaver larynges, *Ann Otol Rhinol Laryngol*, 98: 135-140.
4. Miller T (1978) *Elementy statystyki medycznej*, Wydanie I. PZWL, Warszawa.
5. Sprinzl GM, Eckel HE, Sittel C, Pototschnig C, Koebke J (1999) Morphometric measurements of the cartilaginous larynx: An anatomic correlate of laryngeal surgery, *Head-Neck*, 21: 743-750.
6. Zieliński R (2001) Evaluation of laryngeal diameters in aging population, *Folia Morphol*, 60, 2: 73-78.
7. Żakowska-Wachefko B, Pędzich W (1995) *Pacjenci w wieku starszym*. PZWL, Warszawa.