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ANTHROPOMETRIC MEASURES FOR THE INTRODUCTION OF THE NASOGASTRIC TUBE FOR ENTERAL NUTRITION EMPLOYING THE ESOPHAGOGASTRODUODENOSCOPY

Medidas antropométricas na introdução da sonda nasogástrica para nutrição enteral empregando a esofagogastroduodenoscopia

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ABSTRACT - *Background* -The correct placement of a nasogastric tube for enteral nutrition is subject of several investigations, demonstrating the controversy of the procedure. ***Aim*** - To establish an external measure that can correspond to the internal measurement which determines the insertion length of nasogastric feeding tube up to the stomach. **Methods** - External measures were obtained between points: nose tip vs earlobe vs xiphoid appendix vs umbilicus and height correlated with the standard measures obtained from patients undergoing diagnostic esophagogastroduodenoscopy. ***Results*** - It was found a significative statistical correlation between esophagogastric junction, identified during the esophagogastroduodenoscopy, with the distance measured between the anatomic points of the earlobe and xiphoid appendix (r= 0.75) and from this line with the orthostatic height (r=0.72). ***Conclusion*** - The distance between the earlobe to the xiphoid appendix (0.75) and the distance between the earlobe to the xiphoid appendix to the midpoint of the umbilicus, subtracting the distance from tip of nose to earlobe, were safe anatomical parameters to reach the esophagogastric junction. The height in the standing position (r= 0.72) also can be used as an indicator of the length necessary to insert the tube into the stomach. The height in the standing position (r= 0.72) also can be used as an indicator of the length necessary to insert the tube into the stomach.

HEADINGS - Tube feeding. Enteral nutrition. Anthropometry. Esophagogastroduodenoscopy.

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RESUMO - *Racional* - O correto posicionamento da sonda nasogástrica para nutrição enteral tem sido alvo de várias investigações, demonstrando as controvérsias e a complexidade do procedimento. ***Objetivo*** - Prever as medidas antropométricas para realizar a inserção de sonda para nutrição enteral até o estômago empregando a esofagogastroduodenoscopia para calcular-se o comprimento necessário até o estômago. ***Método*** - Medidas externas foram obtidas entre a ponta do nariz vs lobo da orelha vs apêndice xifóide vs umbigo e altura correlacionadas com a medida padrão obtida em pacientes submetidos à esofagogastroduodenoscopia diagnóstica. ***Resultados*** - Encontrou-se correlação estatisticamente significativa entre a transição esofagogástrica identificada durante a endoscopia, acrescida da distância da rima labial à arcada dentária superior, com a distância compreendida entre os pontos anatômicos lóbulo da orelha e apêndice xifóide (r=0.75). ***Conclusão*** - A distância entre o lóbulo da orelha ao apêndice xifóide (0.75) e a distância entre o lóbulo da orelha ao apêndice xifóide até o ponto médio da cicatriz umbilical, subtraindo a distância da ponta do nariz ao lóbulo da orelha, foram parâmetros anatômicos seguros para estimar-se a distância da transição esofagogástrica. A altura na posição em pé (r = 0,72) também pode ser utilizada como um indicador da distância necessária para inserir o tubo no estômago.

DESCRITORES - Sonda nasogástrica. Nutrição enteral. Antropometria. Esofagogastroduodenoscopia.

INTRODUCTION

The insertion of a nasogastric tube is used to feed patients unable to ingest sufficient nutrients. The procedure is the introduction of a feeding tube through the nose or mouth, going through the pharynx, the esophagus into the stomach and it should be well positioned[1,2].

There are complications that can be associated with errors in the introduction of nasogastric tube (NGT), as esophageal stenosis [3], esophageal perforations [4], pneumothorax [5], insertion of NGT in bronchi [6] leading to aspiration pneumonia causing deaths [6,7,8,9,10]. Many factors may predispose gastric contents into the lung, especially in critical patients: the level of consciousness, supine position,

frequent vomiting, aging and mechanical ventilation[11]. The aspiration risk increases when the tube is near the esophagogastric junction, leading to gastroesophageal reflux, or when displacement occurs after coughing, nausea or vomiting [7,9].

Studies on the correct placement of nasogastric tube for enteral nutrition have been the subject of several investigations, showing the complexity of this procedure[12-15] During practice, it has been observed that there are several parameters regarding the insertion and location of the feeding tube which remains in the stomach[10]. The literature recommends a diversity of points as reference, to establish the length to insert and allocate into the stomach. This diversity of criteria makes difficult the ability to provide a safe assistance to the patient who is under the care of the health team [2,10].

The aim of this study was to evaluate the correlation between a measure internally verified, using esophagogastroduodenoscopy and the measurements on anatomic points externally performed when introducing a nasogastric tube in the stomach, having as reference the esophagogastric junction.

METHODS

Prospective, clinical, descriptive research developed at the Centre of Diagnosis of Digestive Tract Diseases – Gastrocenter - Unicamp, State University of Campinas, Campinas, SP, Brazil. The research was approved by the Ethics Committee of the Institution (CEP protocol number 274/2002). All the requirements were followed, on ethical aspects recommended when conducting research on humans. The patients were volunteers.

Study population

Adult patients, male and female, aged equal or over 18 years, wandering, lucid, from the Unicamp University Hospital and refered to the Gastrocenter to undergo esophagogastroduodenoscopy (EGD). There were excluded patients with mechanical obstruction and morphological alteration in the gastrointestinal tract, with previous gastric surgeries, morbid obesity, with extensive lower limb amputation, with diseases that could affect abdominal anthropometric measurements and those unable to sign the Informed Consent.

Before data collection, they were asked about their availability and consent to participate in the research and they were ensured that their personal identity would remain confidential, and doubts about Informed Consent were answered.

The esophagogastroduodenoscopies were held by only two specialists, minimizing the possibility of error in data collection.

Data colletion

The protocol used was based on Hanson [16], Welch et al. [17] and Ceribelli et al. [15] including characterization data of the patients, the measurements and the anatomic points to be used as reference and measurement of the distance observed during esophagogastroduodenoscopy.

The data were collected after a detailed explanation, describing the research objectives. The patient was sent to a private room in the unit, where the biometric and external measurements were taken. The sitting height, body weight and body height in orthostatic position were obtained with the intention of knowing the patients' biotype and to verify if there were correlation between these variables and standard measurement of the oral cavity until the esophagogastric junction, plus the distance between the labial and upper dental arch. Were used as anthropometric indicators: weight and body height in orthostatic position which allowed the calculating of the Body Mass Index (BMI), anthropometric measurements historical and widely used to evaluate the nutritional status. The patient's weight in kilograms was obtained through a platform anthropometric scale (Filizola – São Paulo, Brazil) with a precision of 0.1 Kg. Then, a small chair was placed on the scale platform to verify the seated patient's measurement, measuring the distance between the top of the head to the hip [16].

Reference points for measurements

The external measure related to the feeding tube route was verified with the patient lying on a stretcher, with the head erect and in rest position aligned to the trunk - the most frequently used position in hospitalized patients in health institutions.

The measurements were obtained with a decimal metric tape. Then, two small identifications were made into the skin with a water-soluble pen in regions corresponding to the xiphoid appendix and in the midpoint of the umbilicus, which were subsequently removed: earlobe to the xiphoid appendix; xiphoid appendix to the midpoint of the umbilicus; tip of the nose to the earlobe and upper dental arch to the lower border of the mandible.

The external measurements between distances were named: the earlobe and the xiphoid appendix as measure 1(med1); the xiphoid appendix and the midpoint of the umbilicus as measure 2 (med2); the tip of the nose to the earlobe as measure 3 (med3) (Figure 1). The distance that corresponds to the sum of the measures 1 and 2, subtracting the measured 3, was named as external measure (extmed). The measure 1 was added to the measurement value obtained during esophagogastroduodenoscopy, because the procedure is performed by inserting the equipment into the oral cavity and for the introduction of the feeding tube it is used the nasal cavity.

In order to decrease the possibility of error during the measurement of the selected points, they were performed three times each, and recorded after verification. The obtained final measures for the final statistical analysis were the arithmetic mean of the measurements obtained.

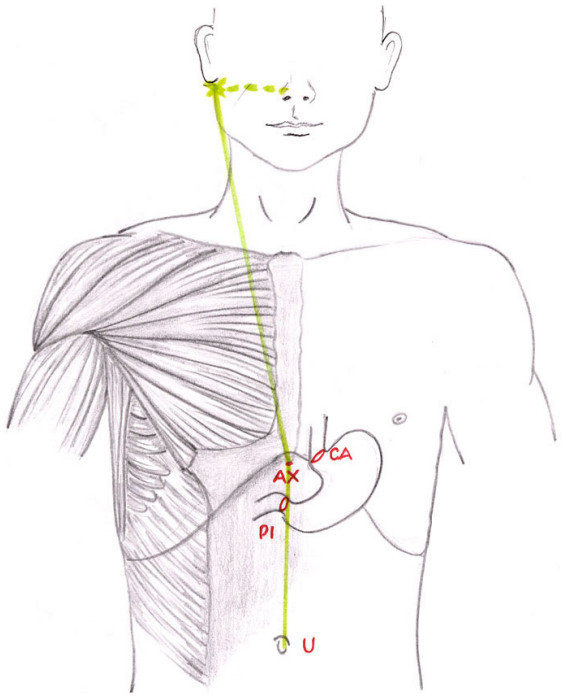


FIGURE 1 – Anatomical landmarks used for the measurements (CA = cardia; AX = xiphoid process; PI = pylorus; U = umbilicus)

Internal measurement

In the examination room, the patient was placed in the left lateral decubitus with slight vertical flexion, the head aligned at the shoulders, with legs slightly flexed and the examination was conducted as routine, after intravenous sedation of the patient. It was used a graduated endoscope of 0.5 to 0.5 cm, introduced into the oral cavity to obtain the distance between the upper dental arch and the esophagogastric junction, identified as zeta line (Z) that coincides with the transition of esophageal squamous epithelium to the gastric columnar. Once the desired point is reached, i.e., the zeta line in the esophagogastric junction, the introduction was stopped to verify the measurement recorded in the endoscope. It was also used a ruler 0.10 cm length, placed parallel to the equipment, to obtain an accurate measure distance from the equipment, graded in 0.5 to 0.5 cm, avoiding failure in reading. The patient was transferred to the recovery room after examination.

Statistical analysis

The results were organized and included in an Excel 2000 spreadsheet. The statistical analysis was performed using the program Statistical Analysis System (SAS - 8.2).

First of all, there was a description of the patients, through the descriptive analysis of all variables: age, weight, standing height and sitting height, med1, med2, med3, extmed1 and then, esophagogastroduodenoscopy was performed. Each variable was correlated with each other and with EGD, through linear regression. To verify the correlation between the variables, it was used the correlation coefficient of Pearson (r), which is a parameter that expresses both strength and direction of a correlation between variables, reflecting the extent to which each subject was able to get the same score on two variables. The relationship between these variables employed scatterplot diagram, which is a chart capable of showing how data are distributed, around an imaginary line. The test t of Student was used to compare if the means of the variables studied differed between genders. A linear regression through the stepwise process was used to calculate the estimated parameters and obtain the best set of variables to predict the EGD value. The level of significance was set at $p<0.0001$.

RESULTS

There were made external and internal measures in 140 patients undergoing esofagogastroduodenoscopies, being 80 males (57.14%) and 60 (42.06%) females. Table 1 shows the measurements obtained.

TABLE 1 – Characteristics of the studied sample and its measurements

VARIABLE	n	Mín	Max	Mean	Standart-deviation
Age	140	18	85	45,2	14,98
Weight	140	40,00	133,00	66,95	14,96
Height[1]	140	1,38	1,98	1,64	0,11
BMI[2]	140	12,62	46,56	25,19	4,80
Height[3]	140	0,98	1,25	1,11	0,05
Med1[4]	140	29,80	44,10	36,88	3,45
Med2[5]	140	13,80	24,00	17,73	2,11
Med3[6]	140	13,00	18,10	15,13	0,90
Medext[7]	140	30,90	46,30	39,47	3,17
EGD[8]	140	32,50	51,00	40,83	3,16

[1]Standing height; [2]Body Mass Index; [3]Sitting height; [4]Measure1; [5] Measure 2; [6] Measure 3; [7]External measure* and [8]Esophagogastroduodenoscopy

Table 2 shows statistical significant variables obtained with the Pearson correlation coefficient.

TABLE 2 – Pearson's correlation coefficients between variables (n = 140)

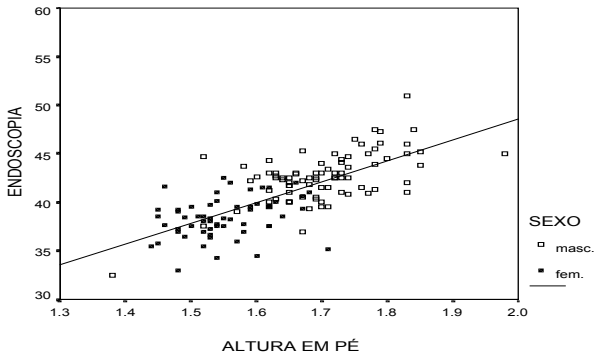
Variable	n	Correlaction (r)	p
Height[1] x EGD	140	0.727	p<.0001
Height[2] x EGD	140	0.644	p<.0001
MED[1] x EGDA	140	0.750	p<.0001
MEDEXT x EGDA	140	0.651	p<.0001

[1] Standing height; [2] sitting height

Analyzing the results in Table 2, it can be concluded that esophagogastroduodenoscopy showed a significant linear correlation with the med1, obtaining a Pearson correlation coefficient (r) of 0.750 (p <.0001), and standing height also showed Pearson correlation coefficient of 0.727 (p <.0001). On the other hand, there was moderate correlation with the medext, with a coefficient of 0.651 (p <.0001).

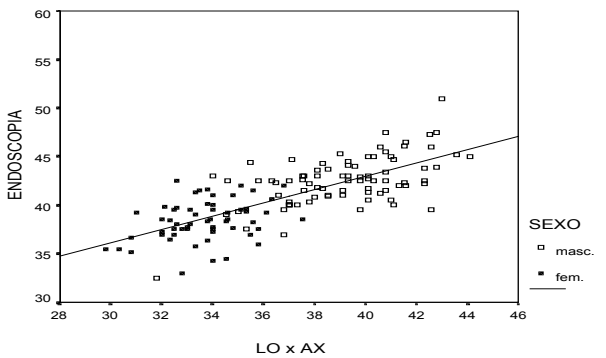
Figures 2 to 4 show, respectively, the distribution of the values of standing height, med1, and medext comparing the measurements obtained in EGD. The straight line indicates the strength of correlation between the two variables. The direction of the line, in all the figures, indicates a positive correlation.

The t Student test showed a significant difference in measures of esophagogastroduodenoscopy with



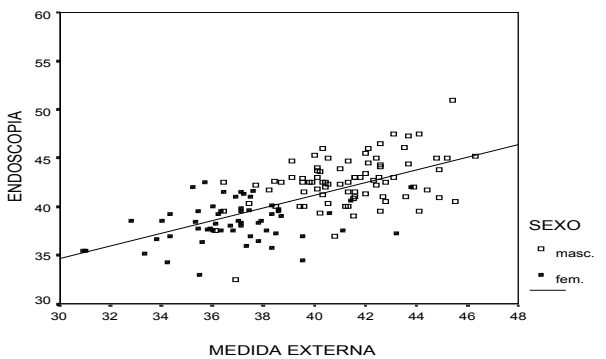
r=0,72; (p<0,0001)

FIGURE 2 - Dispersion relation between esophagogastroduodenoscopy measures and standing height (n = 140)



r=0,75; (p<0,0001)

FIGURE 3 - Dispersion relation between esophagogastroduodenoscopy and measure 1 (med1) (LO vs AX) (n = 140).



r=0,65; (p<0,0001)

FIGURE 4 - Dispersion relation between esophagogastroduodenoscopy and external measure (medext) (n = 140)

med1 and medext compared between genders, all with p<.0001. Therefore, the gender variable was included in a multivariate model, selected by the stepwise process.

Analyzing the EGD results by the t Student test, in relation to gender, it was found in females an average of 38.3 cm and for males and average of 42.5 cm. The total sample had a mean of 40.8 cm. Therefore, the results of the males are closer to the predicted values.

DISCUSSION

The lack of proper nutrition causes impact on the cicatrization, on the efficacy of medical treatment, morbidity and mortality, and time spent in the hospital. The incidence of malnutrition in hospitalized patients is high, which is alarming. According to the Brazilian Nutrition Examination Survey (IBRANUTRI, 1997) [18], held in public hospitals in 1996, it was found malnutrition incidence of 48.1% in hospitalized patients. And other studies conducted in several countries, such as Spain, United States, Canada and Netherlands also showed a high prevalence (31-50%) of malnutrition[19].

The imbalance between nutrients and individual needs caused by factors such as decrease in daily supply, increased requirements, the altered nutrient use and longer fast and determine malnutrition in the hospital. To maintain the vital structure and the existing reserves in the organism, enteral nutrition therapy is the method of choice for patients who have a functioning gastrointestinal tract. It is the best option to manage essential needs in hospitalized patients and critically ill.

Reviewing the publications in journals and medicine and nursing books on anatomical points to determine the extent of nasogastric tube to enteral nutrition that should be inserted from the nose into the stomach, it was observed controversial points in adults and children [15,16,20,21]. Therefore, due to the importance of the tube for nutrients in an adequate place for absorption and with less risk to the patient, it is necessary to conduct studies that demonstrate the points of external measurement, preventing iatrogenic hospital infections, minimizing the risk of aspiration pneumonia. And considering the complexity of this procedure, nurses and doctors should be aware to the importance of proper and safer technique.

This study analysed the correlation between external measurement of anatomical points, tip of the nose, earlobe and xiphoid appendix compared to internal measurement using esophagogastroduodenoscopy, with reference to the esophagogastric junction. Predictive values, related to all measurements, constitute a good accuracy, with improved correlation compared to Hanson's previous studies[16]. The results of this study show that the measurement with earlobe to the xiphoid appendix predicts the correct length to reach the esophagogastric junction.

Hanson [16] did a research on 105 people, being 95.1% of cadavers and 4.9% of adult volunteers, looking for a suitable external measurement to insert the feeding tube in the stomach, obtaining as a measure correlation (r = 0.52) the distance between nose x ear x xiphoid appendix (NEX). Although the author determined the external measure, to measure the tube length into the lower esophageal sphincter, he obtained correlation coefficient with low significance. The data show a p<0.0001, and a correlation coefficient (r = 0.522) of Pearson. By other hand, Beckstrant [20] demonstrated that this measure failed in intragastric positioning in 28% of the sample of adult cadavers and it was considered too long.

In this study, the practical length usable at bedside - which approaches the one established by EGD (r = 0.75)

to measure the length of the tube to be introduced is the external measure – is the one obtained from the earlobe to the xiphoid appendix. This measure was not mentioned in previous studies and reviewed publications.

In Hanson's study[16] when the simple linear correlation was made, between all the variables proposed, the best correlation was obtained with height (r = .56). This fact was also found in the studies done by Strobel *et* al. [22] studying a population of one month old to 18 years-old adults, obtaining highly significant correlation (r = 0.96).

According the results of the studies made by Hanson [16] and Strobel et al. [22], this study showed a significant correlation between height and internal distance to the esophagogastric junction (r = 0.72). However, the sample used by Hanson [22] comprised 95% of cadavers, whereas in this study the population was composed of healthy and wandering patients.

Another aspect to be considered is the relationship of the measurement obtained from the dental arch until the esophagogastric junction. Strobel et al [22] compared the length of the esophagus (cm) and age (years). At birth, the esophagus has from 17 to 18 cm long, 33 cm in adolescence and in adults between 38 and 40 cm. Kalloor et al. [23] performed measurements in 26 patients, to determine the length of the esophagus using endoscopy, obtaining values between 33 and 45 cm, with a mean of 39.2 cm.

The length values obtained in this study from the incisors to the zeta line was 32.5 and 42.5 cm, with a mean of 37.5 cm. The difference among 1.7 cm of the two studies can be justified by the difference between the body positions. The positioning of the tube in this study was performed by placing the patient in left lateral decubitus position and with the head bent, different from that used by Kallor et al. [23], where patients were measured with the head in hyperextension.

The best correlation in this study corresponded to measure 1 (from earlobe to xiphoid appendix) that had the best correlation (r = 0.76), with a correlation coefficient of 57% and 5cm mean between values for EGD for both genders.

The best position to place the tube in the stomach, according to Hanson (1979), is in the distal antrum extremity, favoring the digestion of nutrients and possible preventing gastroesophageal reflux. And to ensure that the distal extremity of the tube is far from the esophagogastric junction, it is suggested the addition to the measure 1 (earlobe x xiphoid appendix) the distance of the xiphoid appendix to the umbilicus (Figure 1).

The findings in this study have important implications for the medical and nursing staff. From the moment we are aware of the responsibility and risks associated with the technique of nasogastric tube insertion, we should be able to plan a better care to minimize the deleterious effects and be safer to the patient.

CONCLUSION

The distance between the earlobe to the xiphoid process (0.75) and the distance between the earlobe to the xiphoid process to the midpoint of the umbilicus, subtracting the distance from tip of nose to earlobe, were safe anatomical parameters to estimate the distance to the esophagogastric junction. The height in the standing position (r= 0.72) also can be used as an indicator of the length necessary to insert the tube into the stomach.

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