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Original Research Article.

To Study the Anatomical Parameters of the Neck in North Indian Population

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ABSTRACT

Background: The Airway management is the key point in management of emergency conditions. The important landmarks in the neck skeletal elements can be used for measuring different parameters. The present cross-sectional study was conducted to determine and identify neck parameters in North Indian population.

Materials and Methods: The study was conducted in Department of Anatomy, Teerthanker Mahaveer Medical College & Research Centre, TMU, Moradabad, Uttar Pradesh (India) over a period of 2 years. Following parameters will be measured in centimeters:- Thyromental distance (TMD), Sternomental distance (STMD), Ratio of height to thyromental distance (RHTMD), Neck circumference (NC). Mean, Standard deviation and standard error was calculated. The comparison of the means of the dimensions was made using 2-tailed't' test. The 'p' value of less than 0.05 was considered statistically significant.

Results: The results of the study showed that in male subjects mean age taken was 19.65±2.07, height 1.68±6.39, weight 62.05±8.7 and BMI 21.93±3.2 and in females subjects mean age was 19.15 ± 1.69, height 1.57± 7.5, weight 55.02 ± 10.45 and BMI 22.09 ± 3.55. Difference in height and weight of both genders was statistically significant (<0.05). Whereas difference in age and BMI of both genders was statistically insignificant (>0.05). In male population the mean and standard deviation for TMD was 8.67 ± 1.39, STMD was 18.19 ± 1.34, NC was 36.79 ± 3.11, RHTMD was 19.89±2.93. In female population the mean and standard deviation for TMD was 8.89 ± 1.11, STMD was 17.27± 1.65, NC was 32.93 ± 2.31, RHTMD was 18.01 ± 2.16. A statistically significant difference (<0.05) was found in STMD, NC, RHTMD in both genders but in TMD no significant difference was found. A statistically significant (<0.05) positive correlation is found between NC and age of subjects. A statistically significant (<0.05) positive correlation is found between STMD, NC, RHTMD and Height of subjects. A statistically significant (<0.05) positive correlation is found between STMD, NC, and Weight of the subjects. The statistically significant (<0.05) positive correlation is present between NC and BMI of subjects.

Conclusion: The study concluded that a statistically significant difference was found in STMD, NC, RHTMD in both genders but in TMD no significant difference was found. A statistically significant positive correlation is found between NC and age of subjects. A statistically significant positive correlation is found between STMD, NC, RHTMD and Height of subjects, weight of the subjects. The statistically significant positive correlation was present between NC and BMI of subjects.

Keywords: Thyromental Distance (TMD), Sternomental Distance (STMD), Ratio of Height to Thyromental Distance (RHTMD), Neck Circumference (NC).

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INTRODUCTION

The important landmarks in the neck skeletal elements (Hyoid and thyroid cartilages) that can be used for measuring different parameters. Below the chin, In the receding angle the hyoid bone, situated opposite to the fourth cervical vertebra.[1,2] The midline structure located in the anterior neck is the Thyroid gland.[3] A finger's width below there is the laryngeal prominence (ADAM´s Apple) of the thyroid cartilage.[1] There is a space in between the hyoid bone and the thyroid cartilage which is occupied by hyothyroid membrane. In the front of neck the cricoids cartilage forms important landmark on the front of the neck; it lies opposite the sixth cervical vertebra, and indicates the junctions of pharynx with esophagus, and larynx with trachea. Under the cricoid cartilage the trachea can be felt.[4] There are different parameters to access the difficult airway assessment based on various anatomic parameters of upper airway, much of it being concentrated on oral cavity and the pharyngeal structure. It is

found that misidentification of the cricothyroid membrane is common and particularly in the female population.[5,6] The importance of this study was to estimate exact anatomic features of the neck that can be measured preoperatively with minimal patient cooperation and to assess their diagnostic value in predicting difficult direct laryngoscopy.[7]

MATERIALS AND METHODS

The Cross-sectional study to determine and identify neck parameters in north Indian population. The study was conducted in Department of Anatomy, Teerthanker Mahaveer Medical College & Research Centre, TMU, Moradabad, Uttar Pradesh (India) over a period of 2 years. Sample consists of 200 students (100 male & 100 female) of North Indian population. Sample was selected using Simple random sampling. Subjects from North Indian population between 18 to 25 years of age and both genders were included in the study. Subjects of age < 18 and > 25 years, severe obesity (BMI more than 35 kg/m^2), cervical spine abnormalities, swelling in neck, not giving consent for the study were excluded from the study. Following parameters will be measured in centimeters:-

1. Thyromental distance (TMD),
2. Sternomental distance (STMD),
3. Ratio of height to thyromental distance (RHTMD)
4. Neck circumference (NC)

Measurements of the thyromental distance (TMD), sternomental distance (STMD), ratio of height to thyromental distance (RHTMD) and neck circumference (NC) was performed in all students by the same Investigator using a measuring tape. The measurements were performed twice and the average of the two results was adopted.

TMD: The TMD is defined as the straight-line distance (cm) from the lower border of the thyroid notch to the bony point of the mentum, with the head extended and the mouth closed.

STMD: The STMD is defined as the straight-line distance (cm) from the bony point of the mentum to the upper border of the manubrium sterni, with the head extended and the mouth closed.

NC: NC (cm) is measured with the head erect and eyes facing forward, by using a flexible tape positioned horizontally at the upper margin of the laryngeal prominence.

RHTMD: It is defined as the ratio of height to thyromental distance.

Stature was measured as the vertical distance between the point vertex (highest point of the head when the head is held in the Frankfurt horizontal plane and the floor. The subject was made to stand bare foot in an anatomical position on the base board. Then the height was recorded in centimeter from the standing surface to the vertex using a stadiometer. The landmarks are marked by the marker and the scales are aligned on it parallel to the floor. The distance between the two scales was measured[8]. The data obtained was recorded on Microsoft excel sheet Mean, Standard deviation and standard error was calculated. The comparison of the means of the dimensions was made using 2-tailed't' test. The association between variables was investigated by means of pearson's correlation coefficient. The 'p' value of less than 0.05 was considered statistically significant.

Table 1: Demographic profile for Male and females

Demographic profile	Descriptive statistics Males (n= 100)		Descriptive statistics Females (n= 100)	
	Mean	**Std. Deviation**	Mean	**Std. Deviation**
Age	19.65	2.076	19.15	1.695
Height	1.686	6.397	1.577	7.506
Weight	62.05	8.707	55.02	10.45
BMI	21.93	3.206	22.09	3.556

Table 2: Comparison of demographic profile in both genders

Demographic profile	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	**Sig**	**t**	**Df**	**P-value**	**Mean Difference**	**Std. Error Difference**	**95% confidence interval difference**	
								Lower	**Upper**
Age	3.910	0.049	1.865	198 190.42	0.064	0.500	0.268	-.0286	1.029
Height	1.125	0.290	10.99	198 193.15	0.0001	10.839	0.986	8.8941	12.784
Weight	0.345	0.557	5.171	198 191.73	0.0001	7.03500	1.361	4.3519	9.7180
BMI	0.331	0.566	-0.334	198 195.91	0.738	-16010	0.479	-1.1042	0.7840

Table 3: **Descriptive statistics for male**

Neck Parameters	Males		Females	
	Mean	Std. Deviation	Mean	Std. Deviation
TMD	8.6750	1.39634	8.8990	1.11342
STMD	18.1950	1.34753	17.2720	1.65829
NC	36.7970	3.11962	32.9360	2.31497
RHTMD	19.8949	2.93639	18.0194	2.16765

Table 4: **Comparison of Neck Parameters in both genders**

Demographic profile	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig	T	Df	P-value	Mean Difference	Std.Error Difference	95% confidence interval difference	
								Lower	Upper
TMD	0.890	0.347	-1.25	198 188.650	0.211	-0.224	0.17859	-0.576	0.128
STMD	3.911	0.049	4.32	198 190.04	0.000	0.923	0.21368	0.501	1.344
NC	0.384	0.536	9.94	198 182.66	0.000	3.861	0.38847	3.094	4.627
RHTMD	3.861	0.051	5.14	198 182.19	0.000	1.875	0.36498	1.155	2.595

Table 5: Correlation of Neck Parameters with age (n=200)

Neck parameters	Pearson Correlation	P value
TMD	-0.047	>0.01
STMD	-0.017	>0.01
NC	0.169**	<0.01
RHTMD	0.035	>0.01

Table 6: Correlation of Neck Parameters with Height

Neck parameters	Pearson Correlation	P value
TMD	0.118	>0.01
STMD	0.492**	<0.01
NC	0.479**	<0.01
RHTMD	0.300**	<0.01

Table 7: Correlation of Neck Parameters with Weight

Neck parameters	Pearson Correlation	P value
TMD	0.084	>0.01
STMD	0.242**	<0.01
NC	0.548**	<0.01
RHTMD	0.123	>0.01

Table 8: Correlation of Neck Parameters with BMI

Neck parameters	Pearson Correlation	P value
TMD	0.028	>0.01
STMD	-0.073	>0.01
NC	0.291**	<0.01
RHTMD	-0.077	>0.01

RESULTS

Data in table – 1 depicts that the mean age subjects for male was 19.65 ± 2.076, height was 1.686 ± 6.397, similarly to weight was 62.05 ± 8.707 and mean BMI subjects was 21.93 ± 3.206. The mean age subjects for female was 19.15 ± 1.695, height was 1.577 ± 7.506, similarly weight was 55.02 ± 10.45 and mean BMI was 22.09 ± 3.556.

Table – 2 reflected that Comparison between both gender according to the age the t value was 1.865 (p value 0.064), for the height t value was 10.99 (p value 0.0001) and followed by for the weight t value was 5.171 (p value 0.001), for BMI t value was – 0.334 (p value 0.738). The result showed that p value of height and weight of both gender was statistically significant (<0.05). Whereas the difference in age & BMI was statistically in significant (>0.05).

Descriptive statistic value for male result showed in table – 3 that mean and standard deviation for TMD was 8.67 ± 1.39, STMD was 18.19 ± 1.34, NC was 36.79 ± 3.11, RHTMD was

19.89±2.93. Descriptive statistic value for female result showed that mean and standard deviation for TMD was 8.89 ± 1.11, STMD was 17.27± 1.65, NC was 32.93 ± 2.31, RHTMD was 18.01 ± 2.16.

The comparison of neck parameter in both genders in Table -4 result showed that the t value of TMD: -1.25 (P=0.211), for STMD t value was 4.32 (p = 0.000), for NC t value was 9.94 (p = 0.000), for RHTMD t value was 5.14 (p =0.000). A statistically significant difference was found in STMD, NC, RHTMD in both genders but in TMD no significant difference was found.

Table 5 Result showed that there is a significant positive correlation between NC (0.169**) with age (p value < 0.01). The negative correlation is present between TMD (-0.047) & STMD (-0.017) with age but it is statistically insignificant. No significant correlation exists between RHTMD (0.035) and age.

Table 6 results find out that there was a significant positive correlation between neck parameters STMD (0.492**), NC (0.479**) & RHTMD (0.300**) with height at the level of p value < 0.01 and no correlation of neck parameters TMD (0.118) at the level of p value >0.01

Table 7 results identified that there was a significant positive correlation of neck parameters STMD (0.242**), NC (0.548**) with weight at the level of p value <0.01 and no correlation of neck parameters TMD (0.084) & RHTMD (0.123) at the level of p value >0.01.

Table 8- result revealed that there was a significant positive correlation of neck parameters of NC (0.291**) with BMI at the level of p value (<0.01) and negative correlation of STMD (-0.073) & RHTMD (-0.077) with BMI. No significant correlation is present between TMD (0.028) with BMI at the level of p value >0.01.

DISCUSSION

The present study depicts that the mean age of subjects of male was 19.65 ± 2.076, height mean score was 1.686 ± 6.397, mean weight was 62.05 ± 8.707. The mean BMI for male was 21.93 ± 3.206. The mean age of subjects of female was 19.15 ± 1.695, height mean score was 1.577 ± 7.506, mean weight was 55.02 ± 10.45. The mean BMI was 22.09 ± 3.556.

In a similar study by Anahita et al[9], the mean age of both genders of subjects was 50±18, the mean height was 169 ± 9, the mean body weight was 75 ± 15 and the BMI mean was 26 ± 4.

The comparison between both gender according to the age the t value was 1.865 (p value 0.064), for the height t value was 10.99 (p value 0.0001) and followed by for the weight t value was 5.171 (p value 0.001), for BMI t value was – 0.334 (p value 0.738). The result showed that p value of height and weight of both gender was statistically significant (<0.05). Whereas the difference in age & BMI was statistically in significant (>0.05).

Chara et al[10] did a study in 2014, in which anatomic features of neck were studied for difficult intubation. The age of the patients considered for study was > 18 years and BMI of the patients was 35 Kg/m^2.

The descriptive statistic of anatomical neck parameters for male, the result shows mean and standard deviation values for TMD as 8.67 ± 1.39, STMD was 18.19 ± 1.34, NC was 36.79 ± 3.11, RHTMD was 19.89±2.93.

Anahita et. al[9] in his study gave the value of TMD as ≤7 cm, STMD as ≤15 cm, RHTMD as >18.4 and NC as >37.5 cm. The RHTMD had the maximum sensitivity (81.4%) and Negative Predictive Value (95.2%), whereas TMD had the utmost specificity (83.9%).

Chara et. al[10] did similar study on population of Greece and found the range of TMD as 8.4 – 8.7 cm, STMD as 19.9-20.5 cm, RHTMD as 19.9 – 20.5 cm and NC was 38.2-39.2 cm in male population. In their study the parameter RHTMD had the maximum specificity and negative predictive value.

The descriptive statistic anatomical neck value for female, the mean value and standard deviation for TMD was 8.89 ± 1.11, STMD was 17.27± 1.65, NC was 32.93 ± 2.31, RHTMD was 18.01 ± 2.16.

Pinar E et al[11] studied NC, hyoid mental distance and sterno mental distance in female population as 40 cm, 6.05 cm and 13.9 cm respectively.

Shah PJ et. al[12] did the study on South Indian population and found the values of TMD (8.5 cm) and RHTMD (20.5 cm).

The comparison of neck parameter in both genders, the results showed that the t value of TMD: -1.25 (P=0.211), for STMD t value was 4.32 (p = 0.000), for NC t value was 9.94 (p = 0.000), for RHTMD t value was 5.14 (p =0.000). A statistically significant difference was found in STMD, NC, RHTMD in both genders but in TMD no significant difference was found.

Chara et al[10] in the population of Greece compared the parameters (TMD, STMD, NC and STMD) in both the genders and found no significant difference. According to them difference in frequency of difficult intubation in males and females is statistically insignificant. But in our study significant difference was seen in the parameters STMD, NC and RHTMD.

CONCLUSION

The study concluded that difference in height and weight of both genders was statistically significant whereas difference in age and BMI of both genders was statistically insignificant. A statistically significant difference was found in STMD, NC, RHTMD in both genders but in TMD no significant difference was found. A statistically significant positive correlation is found between NC and age of subjects.

A statistically significant positive correlation is found between STMD, NC, RHTMD and Height of subjects, weight of the subjects. The statistically significant positive correlation was present between NC and BMI of subjects.

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