Clinical Investigation

Clinical evaluation of nares-vocal cord distance and its correlation with various external body parameters

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Access this article online

Website: www.ijaweb.org

DOI: 10.4103/0019-5049.154997

Quick response code

ABSTRACT

Background and Aims: The optimal visualisation of vocal cords during fibreoptic intubation may be utilised for the nares-vocal cord distance (NVD) estimation. The present study was conducted to measure NVD and to correlate with various external body parameters. **Methods:** This study was conducted on 50 males and 50 females. We measured NVD and analysed its relationship with height, nares to tragus of ear distance (NED), nares to angle of mandible distance (NMD), sternal length (SL), thyro-mental distance (TMD), sterno-mental distance (SMD) and arm span (AS). **Results:** The mean NVD of the males was 18.5 ± 1.5 cm, and that of the females was 15.9 ± 1.1 cm. The relationship between the NVD and body height (males $P = 0.001$, $r = 0.463$, females $P = 0.000$, $r = 0.555$), SL (males $P = 0.000$, $r = 0.463$, females $P < 0.000$, $r = 0.801$) or AS (males $P = 0.000$, $r = 0.561$, females $P = 0.000$, $r = 0.499$) showed a significant correlation but NED, NMD, TMD, SMD did not. After combining male and female groups, ($n = 100$), the correlation of NVD with external body parameters is as follows SL ($r = 0.887$), height ($r = 0.791$), AS ($r = 0.769$), weight ($r = 0.531$), SMD ($r = 0.466$), NED ($r = 0.459$), NMD ($r = 0.391$), TMD ($r = 0.379$). **Conclusion:** The relationship of NVD to external body parameters had strong correlation in all parameters in the combined group; whereas when gender was taken into consideration NVD correlated significantly only with SL, height and AS.

Key words: Nares-vocal cord distance, external body parameters, fibreoptic bronchoscopy

INTRODUCTION

The optimal visualisation of vocal cords during fibreoptic intubation may be utilised for the nares-vocal cord distance (NVD) estimation, which is a very useful measurement for blind nasal intubation, positioning of the nasopharyngeal airway[1] (NPA) or of endotracheal tube as NPA[2] and positioning of temperature sensor.[3]

The present study was conducted to measure NVD and to correlate with various external body parameters in Indian population.

METHODS

After approval from Hospital Ethical Committee, this prospective study was conducted on 100 patients (50 male and 50 female), American Society of Anesthesiologists physical status I-II, in the age group of 18–60 years who presented for elective surgery under general anaesthesia. The exclusion criteria were patient's refusal, body mass index >35, reactive airway disease, difficult airway, high risk for aspiration and patient with history of nasal bleed or rhinitis or polyp or snoring or bleeding diathesis. All patients included in the study were explained the whole procedure and an informed written consent was taken. The following measurements were taken: Height, nares to tragus of ear distance (NED)-from lateral border of the nares to tragus of ear, nares to angle of mandible distance (NMD)-lateral border of nares to angle of mandible, sternal length (SL) distance-from sternal notch to lower border of xiphisternum, thyro-mental distance (TMD)-upper margin of thyroid cartilage

How to cite this article: Sareen B, Kapur A, Gupta SK, Sareen PB, Nischal H. Clinical evaluation of nares-vocal cord distance and its correlation with various external body parameters. Indian J Anaesth 2015;59:212-5.

to chin distance in full extension, sterno-mental distance (SMD)-sternal notch to chin distance in full extension, arm span (AS)-physical measurement of the length from one end of an individual's arm (measured at the fingertips) to the other when raised parallel to the ground at shoulder height at 180° angle to each other, using measuring tape. The age, gender, height and weight of all patients were recorded.

In the operation theatre, routine monitors were attached (electrocardiogram, pulse oximeter, non-invasive blood pressure) and intravenous access established using 18-gauge intravenous cannula. Nasal decongestant xylometazoline (otrivin®) 2–3 drops were instilled in both nostrils 10 min before induction of anaesthesia. Injection glycopyrrolate 0.2 mg, injection midazolam 2 mg and injection pethidine 0.5 mg/kg body weight were given intravenously 2 min prior to induction of anaesthesia. Anaesthesia was induced with intravenous injection propofol 2 mg/kg and vecuronium bromide 0.1 mg/kg body weight was used for neuromuscular blockade. Patient was ventilated with 100% oxygen and 1–1.5% isoflurane using Aladdin's vapourizer with Bain's circuit for 5 min. A well lubricated fiberoptic bronchoscope (FOB) (Karl Storz, outer diameter 5.2 mm) was inserted into the more suitable nostril and advanced down to the vocal cords. Continuous insufflation of oxygen at 4 L/min via working channel of FOB was given during the procedure. The FOB was marked with tape at the nares when the tip of the FOB was positioned precisely between the cords, with head in neutral position. The FOB was then withdrawn and orotracheal intubation was performed using direct laryngoscopy. Thereafter, anaesthesia was continued as appropriate for surgery. The length between the mark and tip of FOB was measured, corresponding to NVD.

The data according to gender were analysed and compared using two sample unpaired two tailed *t*-test. The normality of data was tested by applying non-parametric one sample Kolmogorov–Smirnov test. The power analysis was done retrospectively, observing relationship between NVD and external body parameters (assuming strong positive significant correlation of NVD with external body parameters ($r = 0.001$) for 100 consecutive patients with $\alpha = 0.05$, power 80%). The correlation between NVD and external body parameters was determined by Pearson's correlation coefficient and its statistical significance was determined by two sample unpaired two tailed *t*-test. A $P < 0.05$ was taken as cut point for level of statistical significance. Linear regression analysis of the measured data was performed and the relationships between the NVD and following parameters: Height, NED, NMD, TMD, SMD, SL and AS were analysed. A $P < 0.05$ was considered as significant.

RESULTS

On analysis of the demographic profile, the height and weight were greater in males than in females. The age of males and females was similar. The mean age of males and females (years) was 33.98 ± 11.35, 36.86 ± 11.31, respectively. The NED, NMD, SMD, TMD, SL, and AS were greater in males than females. The mean NVD of males was 18.50 ± 1.5 cm and females was 15.9 ± 1.1 cm [Table 1].

Both in males and females the correlation of NVD with height, SL and AS was statistically significant (<0.001) and regression lines were derived which are shown in Figures 1-3, respectively. The correlation coefficient for the NVD to SL ($r = 0.759$)

Table 1: Demographic data and other body parameters of the patients

Parameters	Males* (*n*=50)	Females* (*n*=50)	Total* (*n*=100)	CI** (male)		CI** (female)		CI** (total)	
				LB#	UB##	LB#	UB##	LB#	UB##
Age (years)	36.9±11.3	34±11.3	35.42±11.4	33.64	40.08	30.75	37.21	33.16	37.68
Weight (kg)	68.2±12.3	52.6±9.4	60.4±13.4	64.69	71.71	49.94	52.26	57.74	63.06
Height (cm)	169.3±6.1	150.6±4.7	159.9±10.9	167.57	171.02	149.23	151.92	157.75	162.09
NED (cm)	14.5±0.7	11.6±0.8	15.01±0.9	15.25	15.65	14.34	14.80	14.84	15.18
NMD (cm)	11.6±0.8	10.8±0.7	14.2±0.8	14.35	14.78	13.60	14.02	14.02	14.35
SMD (cm)	17.4±1.6	15.4±1.5	16.4±1.9	16.91	17.84	15.00	15.88	16.04	16.78
TMD (cm)	8.1±0.8	7.4±0.7	7.7±0.8	7.90	8.33	7.14	7.56	7.56	7.90
SL (cm)	18.4±1.4	16.0±1.1	17.2±1.7	18.03	18.80	15.71	16.33	16.87	17.55
AS (cm)	177.0±8.1	159.9±8.6	168.5±12.0	174.74	179.34	157.44	162.30	166.08	170.83
NVD (cm)	18.5±1.5	15.9±1.1	17.2±1.9	18.075	18.921	15.55	16.182	16.81	17.55

*Values are represented as mean±SD, **CI: Confidence interval, #LB: Lower bound, ##UB: Upper bound. NE distance-from lateral border of the nares to tragus of ear, NM distance-lateral border of nares to angle of mandible, SL distance-from sternal notch to xiphisternum, TMD-upper margin of thyroid cartilage to chin distance in full extension, SMD-sternal notch to chin distance in full extension, AS-physical measurement of the length from one end of an individual's arm (measured at the fingertips) to the other when raised parallel to the ground at shoulder height at a 180° angle to each other. SD – Standard deviation; SL – Sternal length; TMD – Thyro-mental distance; SMD – Sterno-mental distance; AS – Arm span; NED – Nares to tragus of ear distance; NMD – Nares to angle of mandible distance; NVD – Nares-vocal cord distance

was higher than the NVD to AS (0.561) and least with height (r = 0.463) in males [Table 2]. The correlation coefficient for the NVD to SL (r = 0.801) was higher than the NVD to height (0.555) and least with AS (r = 0.499) in females [Table 2]. The correlation of NVD with NED, NMD, TMD and SMD was not statistically significant in both the groups. After combining the groups (n = 100) the correlation coefficients for the NVD to external body parameters in decreasing order are as follows: SL (r = 0.887), height (r = 0.791), AS (r = 0.769), weight (r = 0.531), SMD (r = 0.466), NED (r = 0.459), NMD (r = 0.391), TMD (r = 0.379) [Table 3]. We chose parameters for regression lines which had significant correlation with NVD in male, female and combined group. The formulae for the regression lines in the combined group were: NVD (cm) =0.627 + 0.962 × SL (cm), NVD (cm) =0.135 × height (cm) −4.471 or NVD (cm) =0.119 × AS (cm) −2.946.

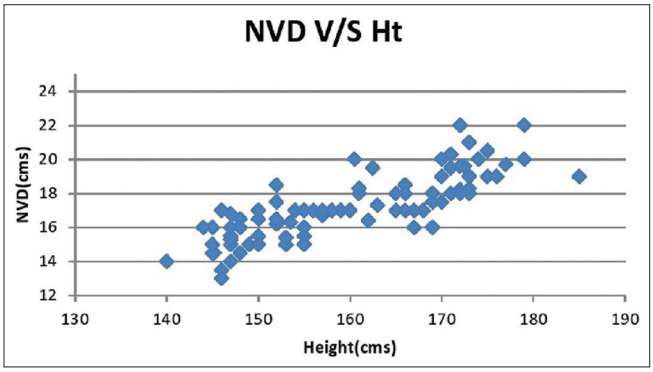

Figure 1: Relationship between the nares-vocal cord (Y-axis) and the height (X-axis)

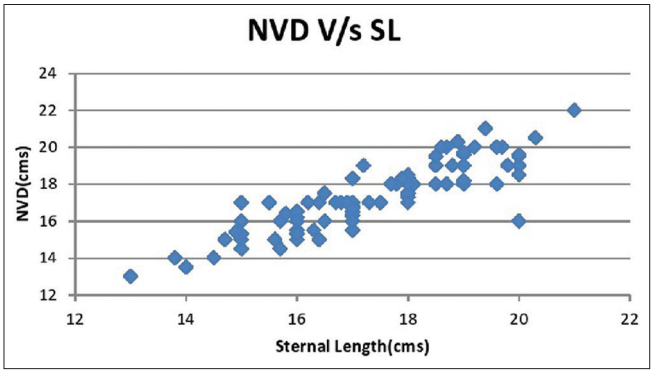

Figure 2: Relationship between nares-vocal cord (Y-axis) and sterna length (X-axis)

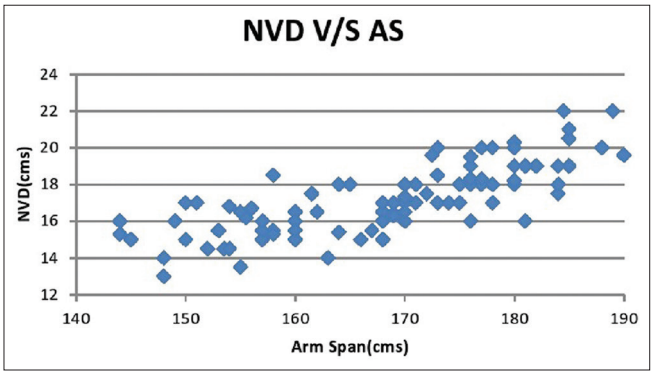

Figure 3: Relationship between nares-vocal cord (Y-axis) and arm span (X-axis)

DISCUSSION

In our study, the correlation of NVD to the SL, AS and body height was significant in all the groups. The Pearson's correlation coefficient for the NVD to other body parameters was in decreasing order of SL, AS, height in males and SL, height, AS in females. This

Table 2: Correlation of NVD with various external body parameters in males and females

Parameters	Pearson's correlation (r)#	P#	Pearson's correlation (r)##	P##
NVD (cm)	1		1	
Height (cm)	0.463*	0.001	0.555*	0.000
Weight (kg)	0.213	0.138	0.178	0.216
NED (cm)	0.129	0.372	0.007	0.964
NMD (cm)	0.210	0.143	0.017	0.914
TMD (cm)	0.137	0.342	0.018	0.900
SMD (cm)	0.169	0.240	0.145	0.314
SL (cm)	0.759*	0.000	0.801*	0.000
AS (cm)	0.561*	0.000	0.499*	0.000

*Strong correlation and P value is significant (P<0.05). #Males, ##Females. NE distance-from lateral border of the nares to tragus of ear, NM distance-lateral border of nares to angle of mandible, SL distance-from sternal notch to xiphisternum, TMD-upper margin of thyroid cartilage to chin distance in full extension, SMD-sternal notch to chin distance in full extension, AS-physical measurement of the length from one end of an individual's arm (measured at the fingertips) to the other when raised parallel to the ground at shoulder height at a 180° degree angle to each other. SD – Standard deviation; SL – Sternal length, TMD – Thyro-mental distance; SMD – Sterno-mental distance; AS – Arm span; NED – Nares to tragus of ear distance; NMD – Nares to angle of mandible distance; NVD – Nares-vocal cord distance

Table 3: Correlation of NVD with various parameters in total patients (n=100)

Parameters	Pearson's correlation (r)	P
NVD (cm)	1	
Height (cm)	0.791*	0.000
Weight (kg)	0.530	0.000
NED (cm)	0.459	0.000
NMD (cm)	0.391	0.000
TMD (cm)	0.379	0.000
SMD (cm)	0.466	0.000
SL (cm)	0.887*	0.000
AS (cm)	0.769*	0.000

*Correlation is significant at the 0.01 level (two-tailed). NE distance-from lateral border of the nares to tragus of ear, NM distance-lateral border of nares to angle of mandible, SL distance-from sternal notch to xiphisternum, TMD-upper margin of thyroid cartilage to chin distance in full extension, SMD-sternal notch to chin distance in full extension, AS-physical measurement of the length from one end of an individual's arm (measured at the fingertips) to the other when raised parallel to the ground at shoulder height at a 180° angle to each other. NVD – Nares-vocal cord distance; NED – Nares to tragus of ear distance; NMD – Nares to angle of mandible distance; TMD – Thyro-mental distance; SMD – Sterno-mental distance; SL – Sternal length; AS – Arm span

suggests that SL can be a better predictor for NVD estimation in both males and females. In individual groups, both NED and NMD did not correlate to NVD. However, on combining the groups, significant correlation between NVD and other external body parameters was found [Table 3].

A similar study in the past found a significant correlation of NVD with both height and NED but not with NMD.[4] In our study, relationship of NVD with NED did not show significant correlation in both males and females groups. However, it had strong correlation with NVD when we combined male and female data (n = 100) which was similar to above study, where male and female data were combined to correlate with NVD. In contrast to that study, our study showed a significant correlation of NVD with NMD in the combined group; however, NMD had insignificant correlation with NVD in both males and females group. This type of study has not been carried out/published in Indian population and the difference in the results might be attributed to the racial differences in skeletal makeup. The formulae which have been proposed by Han *et al*. were, NV length (cm) =0.113 × height (cm) −1.245 or NV length (cm) =1.158 × NE distance (cm) +1.498.[4] As height of the nose may be individualised or show ethnic variations,[5] we took the lateral border of the nares for measurement.

In 2008, a study was conducted in which nasotracheal intubation was performed and while inserting the tube as 'the give' was felt suggesting passage into pharynx the position of the tube was marked black at the external nares. At the time of extubation when the patient was spontaneously ventilating under deep anaesthesia, the nasal tube was withdrawn until the black line became visible. The tube was then left *in situ* as a nasal airway while the patient emerged from anaesthesia. The distance from the drawn line to the tube tip was measured (LT distance). The mean LT distance was 14 ± 1.4 cm in males and 12.4 ± 1.4 in females. There was a correlation between LT distance and patient height (r = 0.4, P = 0.02).[2] We chose SL and AS, because both have a good correlation with height.[6,7]

In addition, knowing the NVD can be useful for a blind naso-tracheal intubation. Blind conscious nasal intubation is useful for an urgent intubation outside the operating room when mouth opening or neck movement is limited or prohibited.[8]

CONCLUSION

The correlation coefficients for the NVD to external body parameters in decreasing order were as follows: SL, height, AS, weight, SMD, NED, NMD, and TMD in the combined group; whereas when gender was taken into consideration NVD correlated significantly with SL, height, and AS and not with the other parameters.

REFERENCES

1. Stoneham MD. The nasopharyngeal airway. Assessment of position by fibreoptic laryngoscopy. Anaesthesia 1993;48:575-80.
2. Vamadevan S, Tricklebank SJ, Vorster TN. Deep Nasal Extubation – A Novel Technique and Estimation of Nasopharyngeal Distance. ASA Annual Meeting Abstract. 2008 Oct; Respiration: (A171). Available from: http://www.asaabstracts.com/strands/asaabstracts/abstract.htm. [Last accessed on 2011 Jan 3].
3. Dorsch JA, Dorsch SE. Temperature monitoring. Understanding Anaesthesia Equipement. 5th ed. New Delhi: Wolters Kluwer (India) Pvt. Ltd.; 2008. p. 863.
4. Han DW, Shim YH, Shin CS, Lee YW, Lee JS, Ahn SW. Estimation of the length of the nares-vocal cord. Anesth Analg 2005;100:1533-5.
5. Aung SC, Foo CL, Lee ST. Three dimensional laser scan assessment of the oriental nose with a new classification of oriental nasal types. Br J Plast Surg 2000;53:109-16.
6. Singh J, Pathak RK, Chavali KH. Skeletal height estimation from regression analysis of sternal lengths in a Northwest Indian population of Chandigarh region: A postmortem study. Forensic Sci Int 2011;206:211.e1-8.
7. Mohanty SP, Babu SS, Nair NS. The use of arm span as a predictor of height: A study of South Indian women. J Orthop Surg (Hong Kong) 2001;9:19-23.
8. Weitzel N, Kendall J, Pons P. Blind nasotracheal intubation for patients with penetrating neck trauma. J Trauma 2004;56:1097-101.

Source of Support: Govenment funded. **Conflict of Interest:** None declared