Naso-laryngeal distances correlate with body size and are not correctly reflected in commercially available preformed nasal tubes

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Background

Preformed nasal endotracheal tubes (NET) have a predefined insertion depth due to their curved design. While size indication refers to internal diameter, there is a considerable variability in the corresponding lengths of same sized tubes of different manufacturers, therefore choosing the best fitting NET is difficult.

Objective

- to describe nasolaryngeal distances (NLD) in an adult population using high resolution CT scans
- to compare these data to available NETs of several manufactures

Methods

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Analysis of 388 CT scans of head, neck and upper thorax: NLD was defined from the nares to the lower border of the thyroid cartilage and segmented based on anatomic landmarks (Figure 2)

Figure 1

Figure 2:
NLDmean: $1+2+(3a+3b1+3b2)/2+4$

NETs from different manufacturers were measured (Figure 1). A required bend-to-cuff-distance (RBTC) as most representable distance for the naso-laryngeal section was calculated, derived from CT measurements, then compared to actual tube measurements

Results

NLDmean ♀ = 163.8 ± 10.8 mm, ♂ = 189.6 ± 9.9

Figure 3: Linear relation of body height and NLD
 $y = 0.11 \times [\text{body height}] - 1,64$
red= ♀, blue= ♂

	[150-160cm]	[161-170cm]	[171-180cm]	[181-190cm]
NLD mean (mm)	160.3±10.4	170.1±12.2	184.5±12.2	189.9±11.5
NLD min (mm)	157.2±10.4	166.7±12.3	181.2±12.2	186.0±11.5
NLD max (mm)	163±10.5	173.5±12.1	187.8±12.4	193.6±11.5
RBTC-distance	193.2	203.7	218.0	223.8

Table 1: Measured NLDs and calculated RBTCs for body height intervals

Tube size I.D.	RÜSCHELIT	RÜSCH Safety Silk	PORTEX POLAR	RAE	Satin RAE	Δ
6.0	21.8	22.2	23.8	22	24.1	2.3
6.5	22	21.8	24.3	22.8	23.8	2.5
7.0	22	22.8	24.7	22.4	25.1	3.1
7.5	22.8	24.3	25.7	24	26.1	3.3
8.0	23.3	25.3	27	24.7	26.2	3.7

Table 2: Differences between bend-to-cuff-distances (cm) relating to product line and internal diameter

Conclusion

- ➔ average naso-laryngeal distances can be correlated with body height
- ➔ calculation of NLD is feasible, building a strong basis for choosing a tube with the required section length
- ➔ manufacturers' tube lengths and intubation guide marks vary substantially
- ➔ lengths do not always correlate with radiographic measurements, carrying the danger of cuff malposition