Rhinology, 32, 148-150, 1994

Objective assessment of posterior choanae and subglottis*†

N.S. Violaris, A.L. Pahor, S. Chavda

Dudley Road Hospital, Birmingham, United Kingdom

SUMMARY

The assessment of children with suspected stenosis of the posterior choanae and the subglottis can be arbitrary and subjective. A study was therefore undertaken to assess the normal size of both posterior choanae and subglottis in normal children and ascertain their relationship. The size of the posterior choanae in 72 children ranged from 3-9.3 mm (3-5.5 mm when less than one year old, and 6.1-9.3 mm when older than one year). The two sides were of equal size in 51 children ($p<0.001$), in 16 children the right side was larger than the left ($p<0.01$), and in 5 children the left was larger than the right side. The subglottic size in 52 children ranged between 4.2-9.3 mm (1.2-5.5 mm when less than one year old, and 6.1-9.3 mm when older than one year). The size of the subglottis was of equal size or within 1.0 mm of the average size of the two posterior choanae in 41 children ($p<0.001$), and of different sizes in 11 children. Accurate and objective assessment of either area can therefore be made by measuring and comparing the two sizes in the same child.

Key words: posterior choanae, subglottis

INTRODUCTION

Subglottic stenosis is a rather common cause of upper airway obstruction in neonates and young infants. Congenital stenosis is usually diagnosed following recurrent stridor or upper respiratory tract infections, and acquired stenosis is frequently caused by a period of perinatal endotracheal intubation for prematurity or other pathology discovered at birth.

The reported incidence of acquired subglottic stenosis is 1-8.3% (Papsidero and Pashley, 1980; Ratner and Whitfield, 1983; Strong and Passy, 1977), especially amongst premature babies. The factors that predispose to stenosis are adequately discussed elsewhere (Bowdler and Rogers, 1987). The normal size of the subglottis in the full-term neonate is variously reported to be 4.5 mm (Holinger et al., 1976; Wilson, 1953) and 5.0 mm (Bailey, 1988). Mostafa (1976) conducted a large study and found that 98.27% of the children could be intubated with a tube which was either the predicted size or one size smaller or larger for that age. A tube two sizes smaller was required for 0.91% of the children, and three sizes smaller for 0.006%. He felt that when the subglottis measured two sizes below normal it is defined as mild subglottic stenosis.

The purpose of this study was to record the normal size of the subglottis in normal children and compare it with the size of the posterior choanae which has not been measured in children previously.

METHOD AND PATIENTS

Seventy-two children were entered into the study. They were undergoing ENT procedures, such as grommet insertion, adenotonsillectomy, laryngoscopy, and bronchoscopy. All had the size of the posterior choanae measured and 52 children had the size of the endotracheal tube used recorded. The outer diameter of a snuggly-fitting uncuffed endotracheal tube corresponds with the internal diameter of the subglottis.

The size of the posterior choanae was measured by gently passing uncuffed "Portex" endotracheal tubes down the anterior choanae and into the nasopharynx. The outer diameter of the largest tube passable was the actual size of the posterior choanae. Three children had a deviation of the nasal septum which prevented the passage of the "Portex" tube down the nose. These children were not included in the study. Only one child suffered from a minor epistaxis (which settled quickly) using this method to measure the posterior choanae. The "Portex" tube size and corresponding outer diameter is shown in Table 1.

* Received for publication October 7, 1992; accepted February 9, 1993

† Presented at the 14th Congress of the European Rhinologic Society in Rome, Italy, October 6-10, 1992

Table 1. "Portex" tube size and corresponding outer diameter.

tube size	outer diameter (mm)
3.0	4.2
3.5	4.8
4.0	5.5
4.5	6.1
5.0	6.8
5.5	7.4
6.0	8.1
6.5	8.7
7.0	9.3

RESULTS

There were 34 females and 38 males. The age ranged between three weeks and 15 years (mean 5.8 years). The size of the posterior choanae ranged from 3.0–9.3 mm. Children under one year of age had posterior choanae sized between 3–5.5 mm, and children older than one year had posterior choanae of a size between 6.1 and 9.3 mm (Figure 1). In 51 children there was no difference between the sides of the posterior choanae, in 16 children the right side was bigger than the left, and in 5 children the left side was bigger than the right. The similarity in size, and the fact that the right side is usually bigger than the left in children that show a difference, are both statistically significant ($p<0.001$ and $p<0.01$, respectively).

However, if we now consider which of these children will probably complain of nasal obstruction (when old enough to appreciate the significance of nasal airway), we need to have a cut-off figure below which there is a likelihood of significant symptoms. We feel that these figures should be 4.5 mm for under-one-year olds and 6 mm for over-one-year olds. With these criteria in mind, only three children from this group (4.2%) are likely to have nasal obstruction as a result of narrow posterior choanae. The first child was two years old with posterior choanae measuring 5.5 and 7 mm, the second child was 3.5 years old with sizes of 5.5 and 5.5 mm, and the third child was 9.2 years old with sizes of 5.0 and 6.5 mm.

The size of the subglottis ranged from 4.2 to 9.3 mm with children under 12 months having a subglottis between 4.2 and 6.5 mm, and children over 12 months have a subglottis between 6.1 and 9.3 mm (Figure 1).

On comparing the size of the subglottis with the average size of the two posterior choanae (Figure 2), 41 out of 52 children had a size equal to or within 1 mm of each other ($p<0.001$), nine children had a slightly wider subglottis, and two children had a slightly narrower subglottis.

DISCUSSION

Bilateral choanal atresia presents itself immediately at birth and if not recognized and treated, it can be fatal. Unilateral choanael atresia, however, is often missed and is not diagnosed until late childhood or adulthood when the patients complain of unilateral nasal obstruction and rhinorrhoea. No work has been done as to what constitutes a normal size posterior choanae or what its association is with the size of the subglottis.

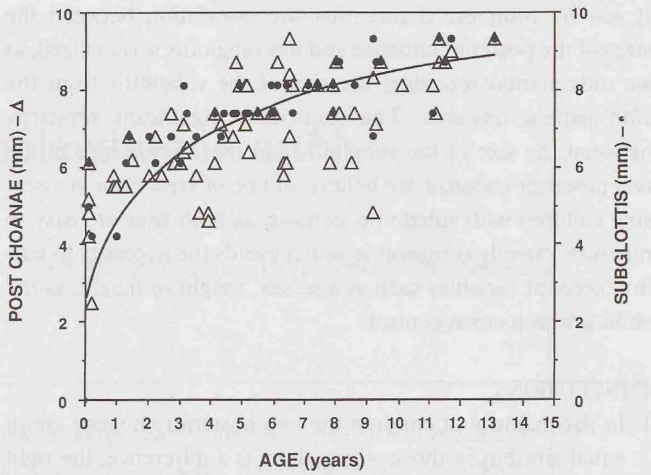

Figure 1. The sizes of the posterior choanae and subglottis in relation to age.

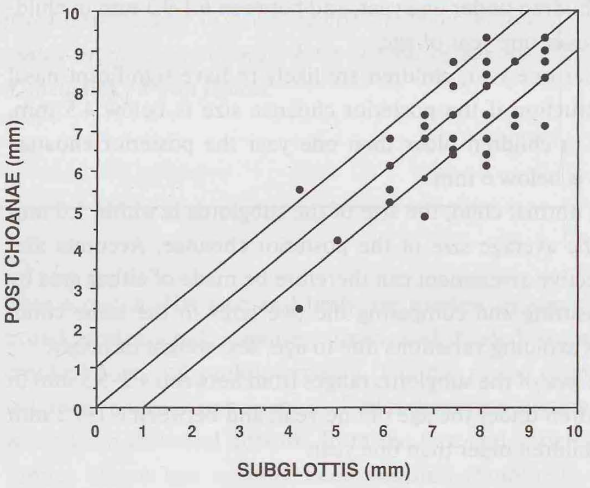

Figure 2. Relationship between sizes of posterior choanae and subglottis.

Furthermore, childhood nasal obstruction is usually attributed to rhinitis (infective, hypertrophic or allergic) or to adenoid hypertrophy, and in the majority of cases this diagnostic span is accurate. It is very rare that an ENT surgeon takes into consideration the possibility of posterior choanal stenosis as the cause of nasal obstruction, probably because it is impossible to measure clinically and simple radiography is not helpful. Coronal CT or MRI are the only diagnostic but expensive ways to assess and compare the size of the posterior choanae (Violaris et al., 1992). However, if the child is anaesthetized for whatever reason it is very simple to measure the size of the posterior choanae by the method described in this paper.

Another excellent method for measuring the various cross-sectional areas in the nose is acoustic rhinometry, originally described by Hilberg et al. (1989). However, a recent publication by Riechelmann et al. (1993) has shown that location and size of the posterior choanae can not be measured exactly, because since the posterior edge of the nasal septum is curved from antero-inferior to postero-superior, the increase of the nasal area distance curve is gradual rather than step-like. Consequently, both the distance from the nostril and the cross-sectional area of the posterior choanae can only be estimated.

It was by complete chance that the association between the sizes of the posterior choanae and the subglottis was realized, as we only started recording the size of the subglottis from the 20th patient onwards. The statistically significant similarity between the size of the subglottis and the average size of the two posterior choanae, we believe will be of great help in assessing children with subglottic stenosis, as both sites are easy to measure, directly comparable, and it avoids the necessity to take into account variables such as age, sex, weight or height, as the child acts as its own control.

CONCLUSIONS

1. In the majority of children the two posterior choanae are of equal size but in those where there is a difference, the right side is usually bigger than the left.
2. The size of the posterior choanae ranges between 3-5.5 mm in children under one year, and between 6.1-9.3 mm in children over one year of age.
3. Under one year, children are likely to have significant nasal obstruction if the posterior choanae size is below 4.5 mm, and in children older than one year the posterior choanae size is below 6 mm.
4. In a normal child, the size of the subglottis is within 1.0 mm of the average size of the posterior choanae. Accurate and objective assessment can therefore be made of either area by measuring and comparing the two sizes in the same child, thus avoiding variations due to age, sex, weight or height.
5. The size of the subglottis ranges from between 4.2-5.5 mm in children under the age of one year, and between 6.1-9.3 mm in children older than one year.

REFERENCES

1. Bailey CM (1988) Surgical management of acquired subglottis stenosis. J Laryngol Otol Suppl 17: 19-24.
2. Bowdler DA, Rogers JR (1987) Subglottic stenosis in children: A conservative approach. Clin Otolaryngol 12: 383-388.
3. Hilberg O, Jackson AC, Swift DL, Pedersen OF (1989) Acoustic rhinometry: Evaluation of nasal cavity geometry by acoustic reflexion. J Appl Physiol 66: 295-303.
4. Holinger PHS, Child JA, Kutnick SL, Hollinger ID (1976) Subglottic stenosis in infants and children. Ann Otol Rhinol Laryngol 85: 591-599.
5. Mostafa SM (1976) Variation in subglottic size in children. Proc Roy Soc Med 69: 793-795.
6. Papsidero MJ, Pashley NRT (1980) Acquired stenosis of the upper airways in neonates: An increasing problem. Ann Otol Rhinol Laryngol 89: 512-514.
7. Ratner RM, Whitfield J (1983) Acquired subglottis stenosis in the very low birth weight infant. Am J Dis Child 137: 40-43.
8. Riechelmann H, Rheinheimer, Wolfensberer M (1993) Acoustic rhinometry in pre-school children. Clin Otolaryngol 18: 272-277.
9. Strong RM, Passy V (1977) Endotracheal Intubation: Complications in neonates. Arch Otolaryngol 103: 329-335.
10. Violaris NS, Patel K, Chavda S, Pahor AL (1992) Does deviation of the nasal septum influence the size of the posterior choanae? Rhinology 32: 84-86.
11. Wilson TG (1953) Some observation on the infantile larynx. Acta Otolaryngol (Stockh) 43: 95-99.

A. L. Pahor, FRCS
Dudley Road Hospital
Dudley Road
Birmingham B18 7QH
United Kingdom