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Does nasal septal deviation influence adult posterior choanal size?*†

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SUMMARY

Despite the development of modern imaging techniques, no study has been carried out to establish the normal size (particularly the area) of the adult posterior choanae. In this study we present our findings of the normal anatomical sizes of the adult posterior choanae and its relationship to septal deviation, by analysing MRI images of 70 patients. Coronal sections through the sphenoid rostrum and axial sections through the nasal septum were used. There were 32 males and 38 female patients. The age ranged between 18 and 73 years (mean 35.6). Our results show that the posterior choanal dimensions were as follows: right area: 1.35–6.1 cm^2 (mean 2.7 cm^2); left area: 1.4–5.9 cm^2 (mean 2.7 cm^2); right width: 0.9-2.1 cm (mean 1.5 cm); left width: 0.9–2.2 cm (mean 1.5 cm); right height: 2.5–4.0 cm (mean 2.6 cm); and left height: 1.5–4.0 cm (mean 2.5 cm). Chi-square analysis showed no statistically significant differences between left- and right-sided measurements. Twenty-three patients had a deviated septum towards the left side, 22 patients towards the right side, and 25 patients had no septal deviation. Chi-square analysis showed no statistical correlation between deviation of the nasal septum and any of the three dimensions of the posterior choanae studied.

Key words: septal deviation, posterior choanae, MRI imaging

INTRODUCTION

Zuckerkandl (1893) was the first to measure the posterior choanae in dry human skulls. Hopman (1895) and Merkel (1896) also published posterior choanal measurements in the same period. More recently, several more papers have appeared, but mainly in the German literature (Hildman et al., 1982; Lang and Baumeister, 1982). Their measurements were done using alginate impressions on post-mortem specimens.

Another long-standing disputed point is the effect of the nasal septal cartilage on the growth of the nose and mid-face. Scott (1953) was the first in postulating the hypothesis that the nasal septal cartilage is the primary growth centre of the upper and mid-facial skeleton. This was based on the following assumptions: 1) in the foetal skull the original nasal capsule is cartilaginous; 2) all the cranial cartilaginous tissues are primary growth centres; and 3) after the prenatal appearance of the intramembranous vomer, the remaining non-ossified portions of the cartilaginous nasal capsule continue to be capable of such interstitial expansion. In Scott's hypothesis, it is assumed that cartilaginous interstitial growth is the major source of the expansive force which "pushes" upon the adjacent mid-facial skeletal structures, causing both vertical and antero-posterior growth.

Wexler and Sarnat (1961, 1965), Sarnat (1963) and Sarnat and Wexler (1966) have examined the effects of removal of the nasal septum in animals. The resulting nasal and facial deformities were regarded by these authors as indicating that the nasal septal cartilages are primary growth sites.

Latham (1970) has described the septo-maxillary ligament, which is found between the antero-inferior portion of the septal cartilage and the maxillary and pre-maxillary ossification centres. He has postulated that the septum would influence the growth of the maxilla by means of a "pull" via the septo-maxillary ligment. Moss et al. (1968) dispute all the above theories and believe that the nasal septum does not play a primary role in normal mid-facial growth, and they suggest that the septal cartilage grows as a secondary, compensatory response to the primary growth of related orofacial matrices.

In this study we present our own experiences using modern radiological techniques (MRI scans and computer measurements). In addition to measuring height and width of the poste-

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rior choanae, as others have done previously, we have also measured the area. All the aforementioned posterior choanal parameters were also compared with any nasal septal deviation to ascertain any causal relationship.

METHOD

MRI scans from 70 patients were analysed. All patients were under investigation for intra- or extracranial pathology, but as far as we know none had any nasal pathology at the time of our investigation. For each patient we selected a coronal image through the posterior choanae at the level of the sphenoid rostrum (for the choanal measurements) and an axial image through the nasal septum and middle of the nose (for nasal septal assessment). The height and width of the posterior choanae were measured by superimposing over the MRI scan a transparent film with a grid divided in mm^2, and the number of squares were counted. The choanal area was measured in the same way and was then cross-checked with computerized measurements, after tracing the outline of the choanal area on the computer screen. The septal position was also noted, with any deviation graded as mild, moderate or severe.

RESULTS

There were 32 male and 38 female patients with ages ranging from 18–73 years (mean 35.6 years). The posterior choanal measurements are shown in Tables 1 and 2. The comparison of the measurements of the two choanal sides is shown in Table 3. Table 4 shows the direction of the septal deviation and Table 5 shows the direction and severity of septal deviation. Tables 6–8 show the direction of septal deviation, if any, in relation to posterior choanal measurements. Chi-square statistical analysis showed that there was no significant difference between the measurements of the two choanal sides. More importantly, there was no statistically significant association between the choanal measurements and nasal septal deviation.

Table 1. Posterior choanal measurements.

	height (cm)	width (cm)	area (cm^2)
right	1.5–4.0 (mean 2.6)	0.9–2.1 (mean 1.5)	1.35–6.1 (mean 2.7)
left	1.5–4.0 (mean 2.5)	0.9–2.2 (mean 1.5)	1.4–5.9 (mean 2.7)

Table 2. Sex of patients and posterior choanal measurements.

	area (cm^2)	height (cm^2)	width (cm^2)
male	2.8	2.6	1.5
female	2.6	2.1	1.2

Table 3. Comparison of the two choanal sides.

	area	height	width
L=R	15 (21.4%)	47 (67.1%)	40 (57.1%)
L<R	30 (42.8%)	13 (18.6%)	16 (22.8%)
L>R	25 (35.7%)	10 (14.3%)	14 (20%)

Table 4. Direction of septal deviation.

right	22 (31.4%)
left	23 (32.9%)
none	25 (35.7%)

Table 5. Direction and severity of septal deviation.

	mild	moderate	severe
right	10	8	4
left	13	7	3
total	23 (50.1%)	15 (33.3%)	7 (17.7%)

Table 6. Area of posterior choanal and septal deviation (DNS).

	DNS to left	DNS to right	no DNS	total
L>R	8	9	8	25
L<R	8	10	12	30
L=R	7	3	5	15
total	23	22	25	70

Table 7. Height of posterior choanal and septal deviation (DNS).

	DNS to left	DNS to right	no DNS	total
L>R	5	3	2	10
L<R	5	4	4	13
L=R	13	15	19	47
total	23	22	25	70

Table 8. Width of posterior choanal and septal deviation (DNS).

	DNS to left	DNS to right	no DNS	total
L>R	5	6	3	14
L<R	6	4	6	16
L=R	12	12	16	40
total	23	22	25	70

DISCUSSION

Hopman (1895) reported that in men the posterior choanae have a mean height of 2.7 cm and a mean width of 1.3 cm, whereas in women it measures 2.5×1.2 cm. Von Luschka (1867) reported values of 2.6×1.3 cm in men and 2.4×1.2 cm in women. Lang and Baumeister (1982) reported values of 2.5×1.3 cm in adults. These values are similar to our own findings of 2.6×1.5 cm in men and 2.1×1.2 cm in women. None of these authors have measured the area of the posterior choanae. We found a mean of 2.8 cm^2 in men and a mean of 2.6 cm^2 in women.

Table 3 shows that in 42.8% of the patients the right posterior choanal area is wider than the left, in 35.7% the left is wider than the right, and in 21.4% the two sides are equal. However, using a two-sample t-test, no statistical significance was found between the area of the two choanal sides. With posterior

choanal height, the right side was higher in 14.3%. In 67.1% of the patients there was no difference between the two sides. With posterior choanal width, the right side was wider in 22.8% and the left in 20%. In 57.1% of the patients the two sides were equal in width. Again, using the two-sample t-test, no statistically significant difference was found between the height and width of the two sides.

The direction of septal deviation was 31.4% to the right, 32.9% to the left, and there was no deviation in 35.7% of the patients; 50.1% of the patients with septal deviation had mild deviation, 33.3% had moderate deviation, and 17.7% had severe deviation. After comparing the posterior choanal measurements with the side of septal deviation we were unable to find any significant association between the two. This leads us to the conclusion that septal deviation does not influence the size of the posterior choanae.

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