

Incidence of Non-metrical Skeletal Variants in Skulls of Pakistani Population-I

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To achieve a more objective racial assessment, sixteen classical epigenetic variants in Pakistani Muslim Crania were studied to assess the measure of divergence among various populations. Incidence of metopism and ossicles at asterion was found 60.8% and 64.8% respectively in Pakistanis, which is considerably higher as compared to other populations. Presence of maxillary torus in 6.8% Pakistani skulls is a distinct entity, not found in other populations. Present study shows that North American claim to be the most distinct population is very closely comparable to Pakistanis.

Key Words: Skull, Cranium

A considerable number of normal discontinuous variations exist in human skeleton. These variations are inherited. They are determined by developmental (epigenetic) thresholds rather than gene action. Cranium has been studied in the past by various workers for epigenetic variants. A few of them have been utilized as anthropological markers.^{1,2} Some diseases or other extrinsic factors have shown themselves to be inherited by a dominant gene with incomplete penetrance.^{3,4,5}

Factors affecting the incidence of non-metrical skeletal variants in 186 human skulls were studied recently and it was proved that incidence of several variants differ in two sexes⁶. Incidence of many variations have also been observed on racial basis⁷. About thirty two "Classical" variants cited in Grays' Anatomy 37th edition were studied by same author with very extensive data. They have assessed which cranial variations exhibit racial and sometimes sexual correlations. Recently 150 adult Pakistani skulls were examined for classical epigenetic variants. 19 out of 32 classical variants were present in one skull along with two additional variants which have not been mentioned in any anatomical text⁸. To achieve a more objective racial assessment, present study was undertaken to observe the incidence of sixteen classical variants in skulls of Pakistani Muslims and to assess the measures of divergence between geo-graphically separated populations of the world.

Material and Methods

The material examined was composed of crania of 92 adult Pakistani Muslims collected from various medical colleges of the Punjab province during 1985-94. The present study was limited to postpubertal crania from both sexes which were in such a condition

as to allow accurate scoring of several variants. Each skull was scored for the presence or absence of 16 non-metrical variants mentioned in Gray's Anatomy, 37th edition. Non-metrical variants occurring bilaterally were scored each time as they occurred and statistical analysis of the following sixteen variants was done.

1. Highest nuchal line
This line arises with the superior nuchal line at the external occipital protuberance and arches anteriorly and laterally.
2. Ossicles at the lambda
A rare bone may occur at the junction of the sagittal and Lambdoid sutures.
3. Lambdoid ossicles
One or more ossicles may occur in the lambdoid suture.
4. Bregmatic bone
A sutural bone may occur at the junction of the sagittal suture with the coronal one.
5. Metopism
Persistence of medio-variants suture throughout life is known as metopism.
6. Coronal ossicles
Sometimes ossicles may occur in coronal suture.
7. Epipterice Bone
A sutural bone or pterion ossicle may be present between the anterior inferior angle of the parietal bone and the greater wing of sphenoid bone.
8. Variants-temporal articulation
Occasionally the variants and temporal bones are connected directly with each other.
9. Ossicles at asterion
A sutural bone may occur at the junction of the posterior inferior angle of the parietal bone with the occipital bone and mastoid portion of the Temporal bone.
10. Auditory tori

- A rare bony ridge or torus may be present on the floor of the external auditory meatus.
11. Posterior condylar canal patent
A patent canal may occur in the condylar fossa.
 12. Condylar Facet Double
Articular surfaces of the occipital condyle may be divided into two distinct facets.
 13. Pre-condylar Tubercle
Occasionally a bony tubercle lies immediately anterior and medial to the occipital condyle.
 14. Anterior Condylar Canal Double
This canal pierces the anterior part of the occipital condyle and transmits the hypoglossal nerve. Sometimes due to the passage of several segments of the nerve the canal may be divided into two.
 15. Palatine torus
A bony ridge running along the midline of hard palate longitudinally.
 16. Maxillary Torus
A bony ridge running along the lingual aspect of the roots of the molar teeth.

Observations

The incidence of sixteen classical variants in the skulls are described in Table-1. The data from males and females have been combined as there are no sex differences in the incidence of the variants. The incidence is based on the number of occurrences of the variants. For interpretation of the data, both methods as described in the previous study⁹ were followed in the present work¹⁰. The first is to take each variant separately and trace its incidence in different populations (Table-1). Second method is to calculate a multivariate distance statistically based on all the variants. For this a method devised by C.A.B. Smith which has been used previously¹¹ was used. For present study a single measure of divergence was calculated between every pair of population (Table-2).

The genetic validity of this method has been discussed before¹². The mean measure of divergence for all the sixteen characters in two populations is a quantitative expression of the separation of the populations. The mean measures of divergence and their standard deviations among all pairs of populations have been calculated and are given in Table -2.

Discussion

The incidence of characters that we have used, are close to the published values for similar populations^{1,2}. The only major discrepancy between present results and published values concerns the incidence of metopism. We found this character in

60.8% skulls which is higher than other populations studied with highest incidence of 7.4% in Palestinians.

Incidence of palatine torus was observed in 5.7% of Pakistani skulls as compared with 2.0% in North American skull. This character has been reported present in 56% in Peruvian skulls¹³ 18.9% in Africans⁹, 0.2% in Peruvian skulls¹⁴ and 19% in Eskimos¹⁴. Variations in the incidence of various populations prove the previous observations that there are two distinct entities that can be scored as palatine torus. Incidence of ossicles at asterion in Pakistan is 64.8%, a considerably higher proportion compared to other populations with highest incidence of 19% in North Americans (Table-1). Maxillary torus present in 6.8% of Pakistani skulls has not been found in other populations. The most distinct population claimed by previous workers⁹ i.e., North Americans are very closely comparable to Pakistanis as is clear from Table-1

North Americans were local tribes perhaps with very limited distribution and descended from only a few forefathers. The reason of distinctiveness of Pakistani population may be due to descendance from limited founders which led to the formation of different clans and beraderies and strict first cousin marriages in most of the clans. The persistence of the characteristics of a population is well documented from gene frequency studies in different types of isolate as shown in the mouse studies of epigenetic variants¹⁵.

For neighbouring groups to be compared to determine the extent of regional variations and to check the possibility of any one sample being derived from an atypical isolate, a critical anthropological argument based on measures of divergence is essential as given in Table-2. Variation in the presence of more than five variants in each skull studied in the present series represents considerable genetic heterogeneity both within and between populations, although it is impossible to be specific about the extent and meaning of this heterogeneity. The morphological characters described in this study may be markers reflecting different diseases and climatic tolerance of different people.

Every epigenetic variant in a person is an indicator of an embryological process and is a record of certain aspects of his development. The processes primarily affected by allelomorphs influencing the epigenetic variants are still not very clear. Epigenetic variations help us to study embryology without dealing with embryos and to compare allometric patterns in different populations and provides us information

Table.1 Incidence of skeletal non-metrical variants in samples from nine populations.

	Egypt Summed	Nigeria (Asharti)	Palestine (Lachish)	Palestine (Modern)	India (Punjab)	Burma	North America	South America	Pakistan (Punjab)
Non-metrical classical variants	n=250 %age	n=56 %age	n=54 %age	n=18 %age	n=53 %age	n=51 %age	n=50 %age	n=53 %age	n=92 %age
Highest nuchal line present	10.4	3.6	16.7	22.2	13.2	12.8	40.0	3.8	27.2
Ossicles at the lambda	14.8	12.5	11.1	22.2	20.7	13.7	28.0	16.9	16.3
Lambdiod ossicles present	32.3	25.9	29.8	33.3	32.1	29.5	54.0	45.2	33.0
Bregmatic bone present 0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metopism	7.2	0.0	7.4	5.5	5.7	0.0	2.0	1.9	60.8
Coronal ossicles present	2.6	0.0	3.7	0.0	1.9	1.0	32.2	1.9	6.5
Epipteric bone present	14.4	6.2	9.5	6.4	16.9	14.7	12.0	7.5	5.0
Variants - temporal articulation	2.0	9.8	0.9	9.7	1.9	3.0	1.0	1.9	3.3
Ossicles at asterion	12.9	14.3	6.5	8.3	8.5	9.8	19.0	14.2	64.8
Auditory tori present	0.0	0.0	0.0	0.0	0.0	0.0	9.0	0.0	12.6
Posterior condylar canal	42.5	33.9	38.5	13.3	41.5	45.0	69.0	70.5	37.0
Condylar facet double	0.2	0.9	0.0	2.8	0.0	1.0	1.0	0.0	13.0
Pre-condylar tubercle	6.9	1.8	5.6	0.0	5.6	9.8	0.0	0.0	4.6
Anterior condylar canal double	16.6	11.6	7.0	8.3	17.9	9.8	24.0	27.4	1.0
Palatine torus present	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	5.7
Maxillary torus present	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8

Table.2 Measures of divergence between geographically separated population.

	Nigeria (Ashanti)	Palestine (Lachish)	Palestine (Modern)	India (Punjab)	Burma	America British-Columbia	Pakistan (Punjab)	
n= Population								
250 Egypt	0.032 (0.013)	-0.005	0.025 (0.019)	-0.0161	0.004 (0.005)	0.151 (0.03)	0.039 (0.015)	0.324 (0.035)
56 Nigeria		0.031 (0.017)	-0.007	0.0213 (0.014)	-0.0034	0.237 (0.047)	0.045 (0.02)	0.416 (0.055)
54 Palestine (Lachish)			-0.0006	-0.0197	-0.006	0.146 (0.037)	0.056 (0.023)	0.309 0.048
18 Palestine (Modern)				0.0023 (0.007)	0.0183 (0.019)	0.192 (0.06)	0.091 (0.041)	0.318 (0.073)
53 India (Punjab)					-0.013	0.129 (0.035)	0.025 (0.015)	0.361 (0.052)
51 Burma						0.162 (0.04)	0.045 (0.02)	0.403 (0.055)
50 North America (British Columbia)							0.115 (0.033)	0.392 (0.055)
53 South America (Peru)								0.446 (0.058)

about human genetic architecture. It may also help us know the aetiology of congenital diseases.

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