

# Incidence Of Non-metrical Skeletal Variants in Pakistani Population-II

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## SUMMARY

*A Considerable amount of normal discontinuous variation exists in the human skeleton. Thirteen classical foramina variants in Pakistani Muslim skulls were observed to assess the measure of divergence between geographically separated population of the world. Mastoid foramen was not found absent even in a single skull as compared to other populations with varying incidences of its absence. Open foramen spinosum was scored highest (95.5%) in Pakistanis. Similarly the incidence of absent Zygomatico facial foramen was significantly high as compared to a second highest in Palestinians. Almost double incidence of accessory infra-orbital foramen in Pakistanis is again significant except South Americans. Presence of exsutural mastoid foramen (71.2%) in Pakistani shows that North Americans claim to be the most distinct populations is closely comparable to Pakistanis.*

## INTRODUCTION

Variations in the foramina, ridges and ossicles of the cranium have aroused the curiosity of Anatomists for many decades<sup>1</sup>. Some of these rare variants have been utilised as anthropological markers. e.g. Persistence of media-frontal suture and imperfect transverse foramina of the cervical vertebrae<sup>2</sup>. Some variants are said to be the consequences of disease or other extrinsic influences<sup>3,4</sup>. Most of these variants result from normal developmental processes and are genetically determined. In laboratory mice, the minor skeletal variants were proved, to be under complex multigenic control. The effects of maternal environment have also been demonstrated<sup>5,6</sup>. The incidence of several variants differ in two sexes and among various races<sup>8</sup>. These normal discontinuous variants are inherited, although they are actually determined by developmental thresholds, rather than by straight forward gene action. The incidence of thirty epigenetic variants in 585 crania from eight different localities points out some of the anthropological and anatomical implications of being able to genetically characterise populations in this way<sup>9</sup>. Recently in 150 adult Pakistani skulls, 19 out of 32 classical variants cited in Gray's Anatomy, 37th

Edition were found present in one skull along with two additional variants (i.e. occipito-mastoid Ossuturale and para mastoid foramen) which were not mentioned in any anatomical text<sup>10</sup>. To achieve a more objective racial assessment, sixteen classical epigenetic variants were studied in Pakistani Muslim crania to assess the measure of divergence among various populations. Pakistan population was found closely comparable to the North Americans claimed to be the most distinct population<sup>11</sup>.

Present study was undertaken to observe the incidence of thirteen classical foraminal variants in skulls of Pakistani Muslims and to assess the measure of divergence between geographically separated population of the world.

## MATERIAL AND METHODS

The material composed of 92 adult Pakistani skulls collected during 1985-96 from Department of Anatomy, King Edward Medical College, Lahore. Each cranium was scored for the presence or absence of 13 classical foraminal variants mentioned in Gray's Anatomy 37th Edition. Non-metrical variants occurring bilaterally were scored each time as they occurred. Statistical analysis of the following variants was done.

1. Parietal foramen present  
It pierces the parietal bone near the sagittal suture in front of the lambda and transmits emissary vein and a small branch of occipital artery.
2. Foramen of Husckhe present (Tympanic foramen of Husckhe)  
It is present in the floor of External auditory meatus.
3. Mastoid foramen exsutural  
Mastoid foramen present outside the suture between the mastoid part of the temporal bone and the occipital bone.
4. Mastoid foramen absent  
Mastoid foramen may be absent.
5. Foramen oval in complete.  
Postero-lateral wall of the foramen oval may be in complete so that the foramen is continuous with the foramen spinosum.
6. Foramen spinosum open.  
Posterior wall of the foramen spinosum may be deficient.
7. Accessory lesser palatine foramen present  
When lesser palatine foramen are more than one.
8. Zygomatico-facial foramen absent.  
A small foramen which pierces the zygomatic bone opposite the junction of the infra-orbital and lateral margins of the orbit. It may be single, multiple or absent.
9. Supra-orbital foramen complete.  
A complete foramen present on the supra orbital margin.
10. Frontal notch/foramen present.  
A foramen present in the vicinity of (usually lateral to) supra orbital foramen.
11. Anterior ethmoidal foramen exsutural.  
Anterior ethmoidal foramen may lie above the suture between medial edge of the orbital plates of the frontal bone and ethmoid bones.
12. Posterior ethmoidal foramen absent.  
It is present behind the anterior ethmoidal foramen.

13. Accessory infra orbital foramen present.  
An additional foramen may lie immediately adjacent to infra orbital foramen.

## OBSERVATIONS

The incidence of various classical foraminal variants in different populations of the world is discussed in Table 1. The data from both sexes have been combined because there is no sex difference in the incidence of variants. The methods of interpretation of the data used were the same as in previous study<sup>11</sup>. In the present study, a single measure of divergence was calculated between every pair of population (Table 2).

## DISCUSSION

Present work has obvious implications for Anthropologists particularly any one who work with non-living populations which can not be characterised serologically. Most of the characters we have used are very close to the published values for similar populations<sup>1,2</sup>. The one major discrepancy between our results and published values concerns the incidence of absent mastoid foramen. It was found absent not in a single skull in this study compared to 7.8% in Burmese and 38.9% in Palestinians. Incidence of open foramen spinosum was scored highest (95.5%) in Pakistanis as compared to South Americans (18.9%), the second highest. The incidence of absent zygomaticofacial foramen in Pakistanis (62.2%) is significantly high as compared to (38.2%) second highest in Palestinians. Posterior ethmoidal foramen was found absent in Egyptians (3.7%), South Americans (1.9%) and Pakistanis (10.6%). In rest of the populations, it is present in all cases. So high incidence of its absence in Pakistanis is highly significant. Two to four accessory infra-orbital foramina were found present in 14.6% of Pakistani subjects which is almost double to that of other populations except South Americans (13.2%) (Table 1). Presence of foramen Husckhe in Pakistani population is significantly low (8.2%) as compared with other populations except in Modern Palestinians (6.1%).

Second maximum incidence of variant scored in Pakistanis was the presence of exsutural mastoid foramen (71.2%). Which is almost double to that of other populations.

Table 1. Incidence of non-metrical variants in different populations.

Non-metrical classical variants	Egypt (Summed) (n=250)	Nigerian (Ashanti) (n=56)	Palestine (Lachish) (n=54)	Palestine (Modern) (n=18)	India (Punjab) (n=53)	Burma (n=51)	North	South	Pakistan (Punjab) (n=92)
							America (British Columbia) (n=50)	America (Peru) (n=50)	
1. Parietal foramen present	44.2%	59.4%	35.2%	22.2%	50.0%	50.0%	62.0%	52.0%	31.9%
2. Foramen of Huschke present	14.0%	30.4%	18.9%	6.1%	22.6%	24.5%	32.0%	46.2%	8.2%
3. Mastoid foramen exsutural	38.3%	36.9%	23.2%	33.3%	46.2%	46.0%	42.0%	39.6%	71.2%
4. Mastoid foramen absent	12.5%	15.3%	38.9%	19.4%	17.9%	7.8%	22.0%	7.5%	0.0%
5. Foramen ovale incomplete	1.4%	3.6%	1.9%	0.0%	3.8%	8.2%	6.0%	0.9%	2.7%
6. Foramen spinosum open	16.0%	7.1%	14.8%	8.0%	13.2%	10.2%	11.0%	18.9%	95.5%
7. Accessory lesser palatine foramen present	48.6%	41.0%	13.2%	23.3%	48.0%	32.0%	71.0%	59.4%	34.3%
8. Zygomatico-facial foramen absent	19.7%	18.7%	30.0%	38.2%	27.9%	17.8%	32.3%	25.0%	62.3%
9. Supra orbital foramen complete	11.2%	11.7%	17.6%	20.6%	12.3%	13.7%	53.0%	30.2%	31.3%
10. Frontal notch/foramen present	32.2%	30.4%	18.5%	20.6%	32.0%	32.4%	40.0%	45.3%	16.2%
11. Anterior ethmoidal foramen exsutural	22.2%	15.5%	7.7%	26.9%	25.5%	25.6%	50.0%	61.9%	30.1%
12. Posterior ethmoidal foramen absent	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	10.6%
13. Accessory infra-orbital foramen present	4.7%	6.4%	2.9%	6.5%	6.7%	7.5%	6.0%	13.2%	14.6%

Table 2: Measures of divergence between geographically separated populations.

Population classified	Nigeria (Ashanti)	Palestine (Lachish)	Palestine (Modern)	India (Punjab)	Burma	North	South	Pakistan (Punjab)
						America (British Columbia)	America (Peru)	
250 Egypt	0.22 (0.12)	0.110 (0.028)	0.035 (0.025)	0.0035 (0.005)	0.021 (0.012)	0.145 (0.033)	0.111 (0.029)	0.46 (0.046)
56 Nigeria		0.076 (0.029)	0.061 (0.037)	-0.15 (0.031)	-0.014 (0.034)	0.119 (0.037)	0.109 (0.036)	0.617 (0.74)
54 Palestine (Lachish)			0.005 (0.011)	0.086 (0.031)	0.098 (0.034)	0.284 (0.058)	0.309 (0.061)	0.619 (0.075)
18 Palestine (Modern)				0.025 (0.024)	0.042 (0.031)	0.189 (0.065)	0.176 (0.064)	0.477 (0.099)
53 India (Punjab)					-0.015 (0.03)	0.076 (0.029)	0.072 (0.029)	0.048 (0.067)
51 Burma						0.12 (0.038)	0.088 (0.033)	0.507 (0.069)
50 North America (British Columbia)							0.031 (0.02)	0.613 (0.076)
50 South America (Peru)								0.526 (0.071)

(The figures in the brackets are estimates of the Standard Deviation)



The most distinct population claimed by previous workers<sup>9</sup>, i.e. North Americans are closely comparable to Pakistanis as it is evident from Table 1.

The reason of distinctiveness of Pakistanis may be descendent from variable forefathers which led to the formation of different clans and beradaries and strict first consign marriages in most of the Beradaries. 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 variants<sup>12</sup>.

To determine the extent of regional variations in neighbouring groups to be compared and to check the possibility of any one sample being given in Table 2.

The epigenetic variant incidences have considerable advantages over morphological measurements for many anthropological purposes. In practical terms the lack of age, sex and inter-character correlation's make the computation of multivariate statistics much simpler than is the case for metrical characters, scoring of variant quick and easy and it is believed that measures of divergence more accurately reflect genetically differences than statistics calculated from metrical data.

Presence of 4-5 variants in each skull represent considerable genetically heterogeneity both within and between populations. Never the less, it is important to recognise the prevalence of this genetically determined variation because the variants we have been studying can be regarded as pleiotropic manifestations of allelomorph which also affect physiological competences<sup>14,15</sup>.

The trivial morphological characters described in this study may be markers reflecting the different diseases and climatic tolerances. Every epigenetic variant is an indicator of an embryological process and the variants possessed by any one individual are a record of certain aspects of his development. This study help in our understanding about human gential architecture, aetiology of congenital diseases and some of the anthropological and anatomical implications of being able to genetically characterise populations in this way.

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