Original Article

Anatomical Variation of Tentorial Hiatus in Indian Population

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Abstract

Introduction: Tentorial hiatus anatomy is varied from individual to individual. Its anatomical variation influences the degree of brainstem distortion in head injury.

Materials and Methods: Anatomical variation of tentorial hiatus is a cadaveric study. Cases excluded from the study are head injury, intracranial pathology, and accidental distortion during dissection. In this study, human cadavers are opened in a standard manner within 12-48 h after death.

Results: In this study, the relationships among the tentorial notch, mesencephalon, and oculomotor nerves were examined in 100 autopsy cases. 100 statistical data were obtained for all variables. The notch length is grouped into short, medium, long; maximum notch width is grouped into narrow, medium, wide by quartile distribution technique. These data are interpolated into a matrix. The tentorial notch is classified from the matrix.

Conclusion: Cephalic index is included in this study and no variable correlated with the cephalic index. Age and sex have no influence over the tentorial hiatus. Anatomical variation is implicated in, a variation of clinical presentation in tentorial herniation.

Key words: Anatomical Variation, Tentorial Herniation, Tentorial Hiatus, Tentorium Classification, Trans Tentorial Approach

INTRODUCTION

Tentorial hiatus anatomy is varied from individual to individual its anatomical variation influences the degree of brainstem distortion in head injury.[1-4]

The aim of this study is to analyze the variation in the anatomy of tentorium in our population, this study helps to obtain baseline measurements of notch length (NL), and notch width in Indian population and analyze the correlation of NL to the size of the skull. This knowledge will help us in various neurosurgical procedures in the skull base. Tentorial hiatus can be easily measured by magnetic resonance imaging (MRI) and pre-operative analysis of the hiatus is useful in the skull base neurosurgical procedures.[5-10]

MATERIALS AND METHODS

Anatomical variation of tentorial hiatus is a cadaveric study. Cases excluded from the study are head injury, intracranial pathology, and accidental distortion during dissection.

In this study, human cadavers are opened in a standard manner within 12-48 h after death. Skullcap is opened in a circular manner. The dura mater over the vertex and the posterior falx are kept intact. The frontal lobes are lifted and the anterior falx is cut. The diencephalon is cut axially above the level of the optic chiasm, through the third ventricle to the apex of the tentorial notch. The cerebral hemispheres are removed, leaving intact a small portion of the diencephalon, the posterior portion of the falx, and the tentorium. The optic nerves are cut proximal to the sella turcica. The optic chiasm is lifted and the mesencephalon cut at the level of the interpeduncular fossa in the axial plane, extending posteriorly. The vein of Galen is cut, the pineal gland removed, and the arachnoid dissected, allowing for a clear view of cerebellar anatomy within the tentorial notch. The field is irrigated to remove fresh blood. Measurements are taken with the help of vernier caliper.

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The following measurements are taken to analyze the morphometric variation of tentorial hiatus in Indian population.

1. Anterior Notch width, the width of the tentorial hiatus in the axial plane through the posterior aspect of the dorsum sellae.
2. Maximum notch width (MNW), the maximum width of the notch in the axial plane.
3. NL, the distance between the superoposterior edge of the dorsum sellae in the median plane and the apex of the notch.
4. Posterior tentorial length, the shortest distance between the apex of the notch and the most anterior part of the confluence of sinuses.
5. Apicotectal distance, the distance from the tectum in the median plane to a perpendicular line dropped from the notch apex to the cerebellum.
6. Interpedunculoclival distance, the distance from the interpeduncular fossa to the superoposterior edge of the dorsum sellae.
7. Cephalic index.

The data obtained from the above measurements are analyzed to classify the tentorial hiatus.

RESULTS AND DISCUSSION

Statistical analysis is performed using SPSS software release 16. Quartile distribution is used to analyze the data. Frequency distribution and parametric and non-parametric correlation among data are analyzed. The correlation which is significant at the level of is worth to mention. The correlation among variables is considered to be significant when the $P < 0.01$ and if it is <0.05, more significant.

In this study, the relationships among the tentorial notch, mesencephalon, and oculomotor nerves were examined in 100 autopsy cases. 100 statistical data were obtained for all variables.

The NL is grouped into short, medium, long; MNW is grouped into narrow, medium, wide by quartile distribution technique. These data are interpolated into a matrix. The tentorial notch is classified from the matrix.

NL
NL less than 48.6 is classified as short.

NL more than 55.9 mm is classified as long.

MNW
MNW less than 27.4 mm is classified as narrow.

MNW more than 31 mm is classified as wide.

The tentorial notch is categorized into six major groups by applying quartile analysis to the NL and MNW over a continuum of values. These groups were classified as long (27% of specimens), short (26% of specimens), and midrange (47% of specimens) for the NL, and wide (26% of specimens), narrow (27% of specimens), and midrange (47% of specimens) for the MNW.

Types of Tentorial Incisura
These groups are combined into matrix. This matrix allowed us, to classify the tentorial notch into nine types. Using NL and MNW as variables tentorial notch is categorized as:

Short and wide	6%
Short and medium	10%
Short and narrow	10%
Medium wide	10%
Classical	25%
Medium narrow	12%
Long wide	10%
Long medium	12%
Long and narrow	5%

Pearson Correlations between the Variables are Analyzed
In this study, MNW positively correlates with the NL. Anterior notch width positively correlates with the MNW. The cephalic index does not correlate with any of the variable studied. There is no significant correlation between the NL and the posterior tentorial length. Apicotectal distance, NL, and the interpedunculoclival distance are positively correlated. There is no significant correlation between the apicotectal distance, interpedunculoclival distance and posterior tentorial length (Tables 1 and 2, Figure 1).

Mean age is 38.7 with standard deviation of 17.13 range from 1 to 77.

Mean anterior notch width is 16.8 mm with standard deviation of 3.51 ranges from 10 to 30.

Mean max notch width is 29 mm with standard deviation of 3.18 ranges from 21.1 to 38 mm.

Mean NL is 52.2 mm with standard deviation of 5.2 range from 36.7 to 66 mm.

Mean post tentorial length is 53.7 mm with standard deviation of 6.88 ranges from 25.8 to 70.3 mm.

Mean Apicotectal distance is 17.9 mm with standard deviation of 4.78 ranges from 4.2 to 30.6 mm.

Mean Interpedunculoclival distance is 16.2 mm with standard deviation of 3.37 range from 7.1 to 24.2 mm.

Mean cephalic index is 81.8 with standard deviation of 8.10 ranges from 67.7 to 133.4.

## Table 1: Statistical Analysis of various distances and cephalic Index

Statistics	Age	Anterior notch width	Max notch width	Notch length	Post tentorial length	AT	ICD	Cephalic index
Mean	38.77	16.8840	29.0320	52.2490	53.7580	17.94	16.26	81.8856
Standard error of mean	1.722	0.35189	0.31895	0.52779	0.68848	0.4783	0.3379	0.81056
Standard deviation	1.713	3.51894	3.18950	5.27788	6.88484	4.783	3.379	8.10564
Minimum	1.00	10.90	21.10	36.70	25.80	4.20	7.10	67.74
Maximum	77.00	30.00	38.00	66.00	70.30	30.60	24.20	133.45
Percentiles								
25	25.00	14.4500	27.4000	48.6000	50.3750	15.50	13.90	77.8492
50	38.00	16.1500	29.2500	52.2000	53.8500	17.80	15.95	81.0692
75	52.00	18.2000	30.9750	55.9750	58.5000	21.17	18.60	84.1806

AT: Apicotectal distance, ICD: Interpedunculoclival distance

Table 2: Correlations

Parameters	Age	Anterior notch width	Max notch width	Notch length	Post tentorial length	AT	ICD	Cephalic index
Age								
Pearson correlate	1	−0.032	0.299**	0.061	0.225*	0.047	0.019	−0.173
Sig. (2-tailed)		0.750	0.003	0.550	0.025	0.643	0.855	0.087
Anterior notch width								
Pearson correlate	−0.032	1	0.282**	0.028	0.071	−0.107	−0.057	0.035
Sig. (2-tailed)	0.750		0.004	0.782	0.480	0.289	0.571	0.726
Max notch width								
Pearson correlate	0.299**	0.282**	1	0.248*	0.263**	0.143	0.194	−0.023
Sig. (2-tailed)	0.003	0.004		0.013	0.008	0.156	0.053	0.821
Notch length								
Pearson correlate	0.061	0.028	0.248*	1	0.122	0.712**	0.388**	0.134
Sig. (2-tailed)	0.550	0.782	0.013		0.228	0.000	0.000	0.185
Post tentorial length								
Pearson correlate	0.225*	0.071	0.263**	0.122	1	0.048	0.074	−0.100
Sig. (2-tailed)	0.025	0.480	0.008	0.228		0.637	0.463	0.321
AT								
Pearson correlate	0.047	−0.107	0.143	0.712**	0.048	1	0.204*	0.079
ICD								
Pearson correlate	0.019	−0.057	0.194	0.388**	0.074	0.204*	1	0.052
Sig. (2-tailed)	0.855	0.571	0.053	0.000	0.463	0.041		0.607
Cephalic index								
Pearson correlate	−0.173	0.035	−0.023	0.134	−0.100	0.079	0.052	1
Sig. (2-tailed)	0.087	0.726	0.821	0.185	0.321	0.436	0.607	

AT: Apicotectal distance, ICD: Interpedunculoclival distance
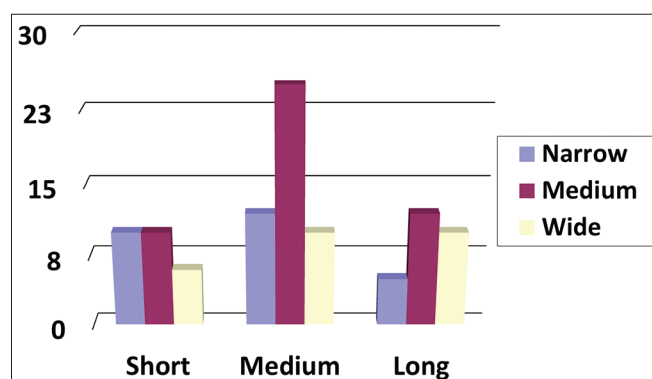
Figure 1: Classification of tentorial hiatus

Mean anterior notch width is 16.8 mm ranges from 10.9 to 30 mm.

Mean max notch width is 29 mm ranges from 21.1 to 38 mm.

Mean NL is 52.2 mm range from 36.7 to 66 mm.

Mean post tentorial length is 53.7 mm ranges from 25.8 to 70.3 mm.

Mean apico tectal length is 17.9 mm ranges from 4.2 to 30.6 mm.

Mean interpedunculo clival distance is 16.2 mm range from 7.10 to 24.20 mm.

Mean cephalic index is 81.8 ranges from 67.7 to 133.4.

Cephalic index is included in this study and no variable correlated with the cephalic index.

CONCLUSION

NL, MNW, interpeduncular, apico tectal, and posterior tentorial distances have been measured in Indian population.

Age and sex have no influence over the tentorial hiatus.

Anatomical variation is implicated in, variation of clinical presentation in tentorial herniation.

Anatomical variation in pre-operative live patients measured by MRI is useful in neurosurgical decision-making.

REFERENCES

1. Corsellis JA. Individual variation in the size of the tentorial opening. J Neurol Neurosurg Psychiatry 1958;21:279-83.
2. Klintworth GK. The comparative anatomy and phylogeny of the tentorium cerebelli. Anat Rec 1968;160:635-42.
3. Bull JW. Tentorium cerebelli. Proc R Soc Med 1969;62:1301-10.
4. Sunderland S. The tentorial notch and complications produced by herniations of the brain through that aperture. Br J Surg 1958;45:422-38.
5. Klintworth GK. Paratentorial grooving of human brains with particular reference to transtentorial herniation and the pathogenesis of secondary brain-stem hemorrhages. Am J Pathol 1968;53:391-408.
6. Ardeshiri A, Wenger E, Wenger E, Holtmannspötter M, Winkler PA. Subtemporal approach to the tentorial incisura: Normative morphometric data based on magnetic resonance imaging scans. Neurosurgery 2006;58 1 Suppl:ONS22-8.
7. Adler DE, Milhorat TH. The tentorial notch: Anatomical variation, morphometric analysis, and classification in 100 human autopsy cases. J Neurosurg 2002;96:1103-12.
8. Stein BM. Supracerebellar-infratentorial approach to pineal tumors. Surg Neurol 1979;11:331-7.
9. Key A, Retzius G. Studies in the Anatomy of the Nervous System. Stockholm: Norstad; 1875.
10. Winslow JB. Anatomical Exhibition of the Structure of the Human Body. Paris: Institution of the Royal Academy; 1732.