

frequency of clinical features of Down syndrome in our country. It also shows the necessity of further studies with large series to predict the incidence of Down syndrome including the translocation variants in our country for proper genetic counseling.

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### Anatomical location and bony reaction in intracranial meningiomas

Intracranial tumors are usually intra-axial, extra-axial or intra ventricular<sup>1</sup>. Of all the intracranial tumors 50% to 60% are supratentorial and the rest are infratentorial<sup>2</sup>. Intracranial tumors represent 1.7% of all tumors and contribute to 1.8% of all deaths due to malignancy. The incidence of tumor of CNS ranges from 10 to 17 per 100,000 persons for intracranial tumors<sup>3</sup>. Meningioma is the second most common primary intracranial tumor in adults<sup>4</sup>.

Meningiomas comprise approximately 20% of adult intracranial tumors.

The distribution of intracranial meningiomas is approximately as follows: convexity (35%), parasagittal (20%), sphenoid ridge (20%), intraventricular (5%), tuberculum sellae (3%), infratentorial (13%), others (4%). Uncommonly sited tumors include intraosseous meningiomas and extraneuroaxial meningiomas. All reported intraosseous meningiomas have been in cranial bones. Extraneuroaxial meningiomas can involve orbit, paranasal sinuses and nasopharynx<sup>5</sup>.

The plain radiograph was used in the past for the detection of intracranial neoplasm and searched for evidence for intracranial calcification and signs of raised intra cranial pressure signs. The signs include sutural diastasis, sellar erosion, and pineal displacement and increased convolutional markings. Confirmation of the presence or absence of brain tumor involved the use of diagnostic procedures such as cerebral angiography or pneumoencephalography that required hospitalization and carried a degree of morbidity and risk.

Abnormalities of bone are frequently encountered in meningiomas. But it is very difficult to appreciate the exact frequency of bony reaction and / or invasion, because very few series mention this particular aspect. Hyperostosis or endosteosis are certainly more common than destruction of bone, and were found in 25% of Cushing cases<sup>4</sup>.

An extensive hyperostosis can occur with a small meningeal tumor, a fact already pointed by Cushing, who separated hyperostosis 'en plaque' meningiomas from bone alterations accompanying 'global' or 'en mass' meningiomas.

Our study of 57 cases was carried out from July 2002 to March 2005. All admitted patients with intracranial meningioma who underwent surgery were considered. A checklist was prepared by the researchers considering the variables such as age of the patients, sex of the patients, clinical features, site of tumor, image findings, per-operative findings and histopathology report. The diagnosis of intracranial meningioma by histopathology was confirmed.

Table I represents the relationship between anatomical location and bony reaction. In case of convexity meningioma, we found 22 (38.6%) such type of case. Among them 36% were of hyperostosis type, 13.6% were erosion type, 4.5% were enmass type and 45.5% were presented without any bony reaction. 17.6% of parasagittal meningiomas

and 75% of sphenoid wing meningiomas were presented with hyperostosis.

**Table I:** Relationship between anatomical location and bony reaction

Anatomical location	Number of bony reaction			
	Hyperostosis	Erosion	En mass	No reaction
Convexity	8	3	1	10
Parasagittal	3			14
Sphenoid wing	3			1
Intraventricular				2
Posterior fossa				2
CP angle				2
Olfactory groove				3
Retrolubar				4
Tuberculum sellar				1

When we observed the columns of bony reactions, we found that 57.1% convexity, 21.4% parasagittal and 21.4% of sphenoid wing meningiomas were presented with hyperostosis. In erosion cases, all the cases were of convexity type. 100% en mass cases were convexity type. 100% of intraventricular, posterior fossa, CP angle, olfactory groove, retrolubar and tuberculum sellar meningiomas were presented without any bony reactions.

When we calculated the relationship between anatomical location and bony reaction by chi-square test 'P' value was 0.008 which was less than 0.05. Significant test was positive. So it can be concluded that bony reaction is significantly related to anatomical location. Bony erosion and en mass meningiomas are significantly common in convexity location.

When we compared our study with other studies we found that, in Cushing's study parasagittal (22%). Meningiomas were highest in percentage followed by convexity meningiomas (18%)<sup>4</sup>. Series of Chan and Thompsan also showed a similar result<sup>5</sup>. According to their study parasagittal was 33 % followed by convexity (21 %). But in the series of Jaaskelainen convexity (21 %) was commonest<sup>6</sup>. Our study confirmed that convexity meningioma (38.6%) is the commonest followed by parasagittal (29.8%). Difference of percentage of meningiomas of different location may be due to geographical and racial variation.

Sphenoid wing meningiomas were found as third most common type in all large series. It was 18% in Cushing's study, 14% in Chan's study and 12% in Jaaskelainen's study. In our

study sphenoid wing meningioma was also in third position. But percentage of cases was less than in comparison to others. In our series it was only 7.0%. One reason of getting less number of sphenoid meningioma in series may be due to less vigorous clinical presentation. These patients usually presents with gradual dimness of vision in one eye which is sometimes being ignored by elderly patients.

Percentage of olfactory groove meningioma was 10% in Cushing study, 8% in Chan's study and 8 % in Jaaskelainen's series. In our study it was 5.3%.

Percentages of intraorbital meningiomas were very less in other studies. It was 2.5% in Cushing's series and none in Jaaskelainen's series. Percentages of intraorbital meningioma of our series was more than other series. It was 7.0% in our study. So it can be said that intraorbital meningiomas are more common in our country in comparison to western countries.

Intra ventricular meningiomas were 3.5% of our study. But it was 1.3% in Cushing's series, 1.5% in Chan's series and 0% in Jaaskelainen's series. It showed a fair similarity between our and others study.

In all series (including our) post fossa meningiomas were found less than 5% of their respective series. It was 3.5% in our series. Similarly it was 5% in Cushing's series.

Al Mefty has classified bony reaction of meningiomas into hyperostosis, bony erosion, en mass and en plaque meningiomas<sup>5</sup>. Though Mefty has mentioned several hypothesis about hyperostosis and bony erosion but he has not shown any relationship between anatomical location and bony reaction elaborately in this study.

Cushing and Eisenhardt published their study on bony reaction of meningioma on 1938. According to their study they found 25% cases of hyperostosis, few cases of bony erosion and only 4 cases of en plaque meningiomas<sup>4</sup>. In this subcontinent, the first article was published in 1970 by Balasubramaniam and Ramamurthi<sup>7</sup>. They found bony reaction in 17.3% cases where as this percentage was 36-77.5% at that time in western literature<sup>7</sup>.

According to our study 24.6% cases were presented with hyperostosis. 5.3% cases were presented with erosion and only 1.85% cases were presented with

en mass meningioma. 68.4% cases didn't show any bony reaction. When we compared our series with other studies we found that hyperostosis cases were common bony reactive subtype in all studies. Second common was erosion cases. En mass meningiomas were low. We didn't find any en plaque meningiomas. This result showed a similarity between our and other studies.

Phemister and others suggested that the meningioma irritates the periosteum, leading to osteoblastic proliferation which leads to hyperostosis<sup>8</sup>. Freedman and Forster demonstrated that the tumor cells themselves take an active part in the production of the hyperostosis is rather than acting only as relative foreign bodies to stimulate bone growth; tumor cells of meningiomas can produce fibroblasts, osteoblast and osteoclasts or act as the latter two without apparent morphological alteration<sup>9</sup>. But we have not performed any histological study of the bony reaction part of bone. So the exact pathology of bony reaction couldn't evaluate in our study.

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