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EVALUATION OF CRANIOVERTEBRAL JUNCTION ANOMALIES USING CT AND MRI

Radiodiagnosis

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ABSTRACT

AIM: Role of CT and MRI in evaluation of craniovertebral junction anomalies.
OBJECTIVES: To study the different radiological Investigations of CVJ anomaly.To study the incidence of various Bony & Soft tissue CVJ Anomalies. To analyse the various etiological factors contributing to CVJ Anomalies.
MATERIALS AND METHODS :A prospective study of 23 patients referred from outpatient and emergency department of SBKS Medical college during August 2019 to January 2020 were studied using CT scan and MRI.
CONCLUSION: MRI is the imaging modality of choice for CVJ evaluation for its superior soft tissue characterization. 3-D reconstructed CT images are better for bony abnormalities at CVJ including lucent fracture lines, displacement of fractured fragments, dislocation, assimilation etc.

KEYWORDS

Congenital anomalies, Trauma, TB

INTRODUCTION

- Craniovertebral junction (CVJ) anomalies can be congenital, developmental or due to malformation secondary to any acquired disease process. These anomalies can lead to cranial nerve compression, vertebral artery compression and obstructive hydrocephalus.[1][4]
- The CVJ Anomalies can be either due to Bony or Soft tissue anomalies. They are common in all age groups and almost equal in both sex groups.[1][2][3][4]
- •The incidence of different types of CVJ Anomalies varies with demographic environment &ill-defined genetic factors. CVJ Anomalies are more frequently found in Indian subcontinent than anywhere else in the world. Even in India, these anomalies are more frequently documented from Bihar, Uttar Pradesh, and Rajasthan& Gujarat. [3]

The craniovertebral junction is formed by the occipital condyles, atlas (C1), axis (C2) vertebrae and their articulations. Any process which can give rise to malformation of these structures, may result in CVJ anomaly. [1][2][3][4][5]

AIMS AND OBJECTIVES

- To study the different radiological Investigations of CVJ anomaly.
- To study the incidence of various Bony & Soft tissue CVJ Anomalies.
- To analyse the various etiological factors contributing to CVJ Anomalies.

MATERIALS AND METHODS

- A prospective study of 23 patients referred from outpatient and emergency department of SBKS Medical college and research institute during August 2019 to January 2020 were studied. Computed tomography (CT) scan was performed on a 16 slice Philips MX16 CT machine and magnetic resonance imaging (MRI) on 1.5T SIEMENS machine. Multiplanar sequences using T1, T2 were used. Final diagnosis was made after MRI findings with clinical correlation.

INCLUSION CRITERIA

- Patients with clinical suspicion of CVJ abnormalities evaluated by CT and Magnetic Resonance Imaging.

EXCLUSION CRITERIA

Claustrophobia, Cardiac implants, unstable patients.

RESULTS AND OBSERVATION:

This is a prospective study of 23 cases of CVJ abnormalities, 14 cases (61 %) congenital anomalies, 5 (22 %) trauma, 2(8 %) tuberculosis,2 (9 %) of rheumatic arthritis. Males were more common than females (3:1). There was maximum incidence of cervicomedullary junction compression and atlantoaxial dislocation followed by Chiari I with syrinx.The combination of OA+AAD was seen in 20% patients. Combination of BI+OA was seen in 14.2% and BI +OA+AAD was seen in 7

Chart 1: Various CVJ abnormalities (Cases / percentage wise distribution)

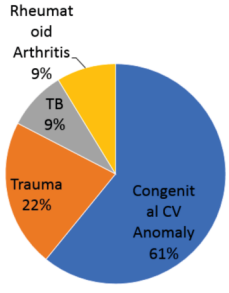


Table 1:Maximum number of patients seen in my study were in age group of 50 years or more.

Age group	Male	Female	Total
0-10	2	1	3
11-20	3	0	3
21-30	3	1	4
31-40	1	0	1
41-50	0	1	1
>50	8	3	11
Total	17	6	23

Table 2: Male to female ratio in Craniovertenral junction anomalies approx 3:1.

Sex	No. Of patients	Percentage
Male	17	73.9
Female	6	26.1

Distribution On The Basis Of MRI Findings :

MRI FINDINGS	NUMBER	PERCENTAGE
ATLANTO AXIAL DISLOCATION	6	26
CHIARI I	6	26
CHIARI II	1	4
SYRINX	10	43
BASILAR INVAGINATION	4	17

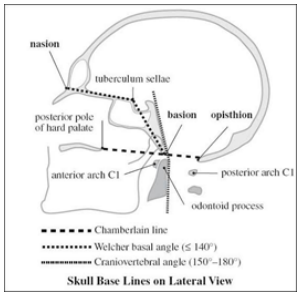
DISCUSSION:

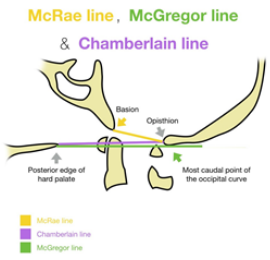
I. Chamberlain's line: Line extend between posterior pole of the hard palate and opisthion. Tip of dens commonly lies below or just tangent to the line or may normally project several mm above this line.[1][2][4]

II. McGregor line: Line between the posterior pole of the hard palate to the lowest portion of the occipito- squamosal surface. Tip of the dens should be <5mm above this line.[1][2][4]

III. McRae's line: Line between the basion and opisthion, tip of the dens should be below this line, if above this line s/o basilar invagination.[1][2][4]

IV. Wackenheim Clivus baseline (basilar line): It is the line along the clivus which is tangential to posterior aspect of the dens. Line should fall tangential to posterior aspect of the dens; if not s/o basilar invagination.[1][2][4]





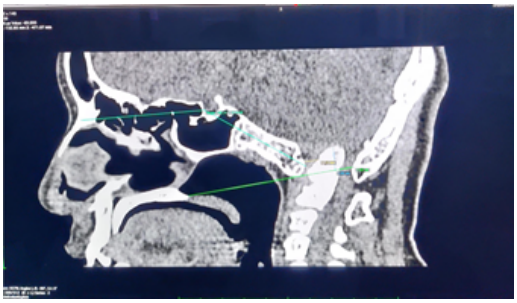
V. Clivus canal angle: Angle formed at the intersection of the Wackenheim clivus baseline with a line constructed along the posterior surface of the axis body and dens. Clivus canal angle should range between 150-180 degree.[1][2][4]

VI. Atlanto-occipital joint axis angle (Schmidt-Fisher angle) - Angle formed by line drawn parallel to both atlanto-occipital joints which typically intersects at the center of the dens when condyles are symmetric. Average angle is 125 degree (124-127 degree) and becomes obtuse in condylar hypoplasia.[1][2][4]

VII. Welcher basal angle – Angle formed by intersection of the nasion-tuberculum line and tuberculum- basion line. It should be less than 140 degree.[1][2][4]

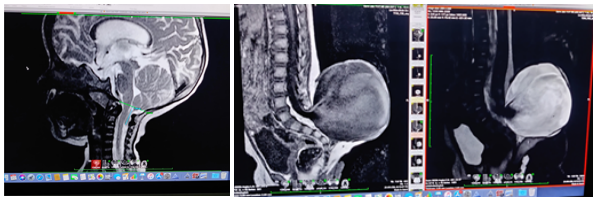
Case I

- C1 vertebra fused with occipital bone suggestive of ATLANTO-occipital assimilation. Dens is retroverted with ATLANTO dental distance of 7.1mm suggestive of ATLANTO-axial subluxation. Dens lies 1.05 cm above chamberlains line suggestive of basilar invagination. Welcher basal angle measure 145 suggestive of platybasia.



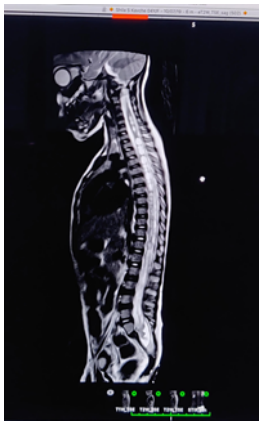
Case 2

Myelomeningocele noted in sacral region with tethered cord.Caudal decent of cerebellar tonsil and vermis suggestive of CHIARI II malformation



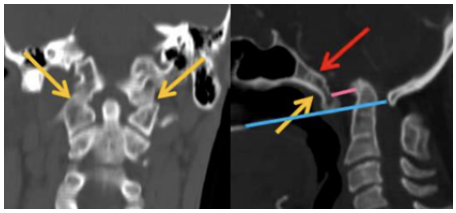
Case 3

Long segment syrinx noted in known patient of CHIARI I malformation with cervicomedullary Junction compression.



Case 4

Atlanta-occipital assimilation. A. CT coronal section showing complete atlanto-occipital assimilation on right side and incomplete atlanto-occipital assimilation on left side. B. CT sagittal section showing complete atlanto-occipital assimilation, short Clivus, violation of Chamberlain's line-basilar invagination and atlantoaxial dislocation.



CONCLUSION

- MRI is the imaging modality of choice for CVJ evaluation for its superior soft tissue characterization. Its multiplanar facility permits the better evaluation of the topographical relationships of structural lesions prior to surgery. Beam Harding artifacts from bone and air containing structures adjacent to brain are eliminated. 3-D reconstructed CT images are better for bony abnormalities at CVJ including lucent fracture lines, displacement of fractured fragments, dislocation, assimilation etc.

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