Original Article

A Study of Normal Variants on CT and MR Imaging Central Nervous System

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Abstract
Aims, Objectives and Background: No two human bodies develop in exactly the same way. Variations among them are common and are considered normal. Nevertheless in certain pathological conditions these normal variants, which would otherwise be considered normal incidental findings, can assume clinical significance because of their resemblance to genuine true to life irregularities and pathologies.

The aim of this study is to help clinicians and academicians, whenever possible, to rule out the possibility of a normal variant on CT and MRI. The study addresses for the most part, the issue of how to distinguish what is normal from the anomalous and how to describe these normal findings.

Materials and Method: The study was done at NKP Salve Institute of Medical Sciences and Lata Mangeshkar Hospital in the region of Hingna and Nagpur where a retrospective and prospective study was performed to describe the normal variations on CT and MRI. Out of the randomly selected 2000 routine scans that were performed from June 2009 to June 2010, there were 50 patients who showcased normal variants in the scan. Out of these, 30 showed anatomical variant in the Brain scans, 10 involving the Musculoskeletal system, 3 involving the PNS, 2 involving the Skull and 5 showed normal variations in the Abdomen cross sectional imaging. These cases were compared to earlier such variations which became a premise to distinguish normal variants from the anomalous. Furthermore these cases were compared with renowned previous studies done at an earlier date. The cases were then classified according to their region and anatomy and results were formulated.

Results and Conclusion: The normal variant cases were classified according to their anatomy and percentage of normal variants to the number of total scans performed was calculated according to the classification. Detailed result and conclusions to be illustrated in subsequent discussions.

Key Words: Normal variants, CT, MRI, Dandy Walker, calcification

Introduction

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Materials and Methods

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Results
Out of the 50 patients who showcased normal variants in the scan, 30 showed anatomical variant in the Brain scans, 10 involving the Musculoskeletal system, 3 involving the Paranasal sinuses, 2 involving the Skull and 5 showed normal variations in the Abdomen cross sectional imaging. These cases were compared to earlier such variations which became a premise to distinguish normal variants from the anomalous. Furthermore these cases were compared with renowned previous studies done at an earlier date. The cases were then classified according to their region and anatomy and results were formulated.

Arachnoid Granulation is a normal variant in the cerebral venous anatomy. These are hypointense on T1 weighted images, hyperintense on T2 weighted images and isointense on FLAIR images. These are thought to be arachnoid villi which have become distended and enlarged in response to increase in CSF pressure. These increase in size and number with age(1,4).

In classic Dandy-Walker malformation includes three criteria: (a) vermian hypoplasia with cephalad rotation of the vermian remnant, (b) cystic dilatation of the posterior fossa communicating with the fourth ventricle, and (c) enlargement of the posterior fossa causing an abnormally high tentorium and torcular. In Dandy-Walker variant the vermis, which is usually hypoplastic, is present and the posterior fossai not as enlarged as in the classic Dandy-Walker malformation. However, the demarication between the two is vague, and thus the term Dandy-Walker continuum is more appropriate. The prevalence of the Dandy-Walker continuum disorders is about 1 per 25,000-35,000 live births worldwide(2).
Mega cisterna magna (enlarged posterior fossa cisterns) was coined by Gonsette et al in 1968(2). It occurs in approximately 1% of all brains imaged postnatally measuring 38 mm (midsagittal plane). In the absence of other findings to suggest a posterior fossa lesion, it is unlikely to be clinically significant.

Septum pellucidum consists of two thin laminae of white matter surrounded by gray matter with a potential intervening space. The leaves are separated in utero but fuse from back to front within a few weeks after birth. It forms the medial walls of the lateral ventricles and extends from the corpus callosum to the columns of the fornix. The cavum septum pellucidum persists when the two leaves fail to fuse. It has not yet been identified with any clinical syndrome, therefore considered a normal variant(1,3).

Vertebral arteries unite to form Basilar artery in front of pons which averages about 3cm in length & 1.5-4mm in width; diameters >4.5mm with the artery extending beyond the pontine cistern indicates Dolicoectasia. It is seen in elderly patients and is considered insignificant (normal variant) if not associated with any neurological complaints(1).
Virchow Robin Spaces are pial-lined extensions of subarachnoid space that surround penetrating arteries as they enter either the basal ganglia or the cortical gray matter over the high convexities. These increase in size with age (normal anatomic variant), hypertension and dementia. MRI reveals these spaces as small rounded or linear perivascular foci that follow CSF on all pulse sequences.

Empty Sella is a very common anatomic variant in which the sella is partially filled with CSF. The infundibular stalk follows its normal course & inserts in the midline of the pituitary gland. The gland appears flattened and thinned against the bony floor.

Choroid plexus calcification is very common finding, usually in the atrial portions of the lateral ventricles. Calcification of the falx, dura mater or tentorium cerebelli occur in about 10% of elderly population. Falcial calcifications usually have a characteristic appearance pattern as dense and flat plaques and are usually seen in the midline of the cerebrum. Calcification of the pineal gland is seen in two-thirds of the adult population, increases with age. Pineal calcification over 1 cm in diameter or under 9 years of age may be suggestive of a neoplasm. Habenula has a central role in the regulation of the limbic system & is often calcified with a curvilinear pattern a few millimetres anterior to the pineal body in 15% of the adult population.
Asymmetry of transverse sinuses is common (50% to 80% of the cases); the right is usually the dominant drainage pattern. Agenesis of part or the entire transverse sinus occurs in 1% to 5% of cases & should not be mistaken for dural sinus occlusion(1).

Perineural cyst (Tarlov cyst) is located at the root sleeve at dorsal root ganglion which should not be mistaken for nerve root tumor. It follows CSF signal intensity on all sequences and is considered insignificant if not associated with neurological symptoms(1).

References
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