Multidetector Computed Tomography Pattern of Physiological Intracranial Calcifications in Nepalese People

Bhattarai S., Adhikari BBS, Pant HP

ABSTRACT

INTRODUCTION: Deposition of calcium compound or any mineral within the brain substances or its linings is called intracranial calcification, which gives rise to hyperattenuation on CT. CT scan is the radiological modality of choice to detect intracranial calcifications. Intracranial calcifications are physiological and pathological. Pathological calcifications are associated with specific diseases which may have other intracranial manifestations whereas physiological calcifications are not associated with any disease. So, pattern of physiological intracranial calcifications is helpful for medical practitioners to suspect any pathological process in the brain if they appear too early or look like too different from physiological ones. Hence, we conducted this study to determine the sites of physiological intracranial calcification with frequencies and to find out the earliest age range of physiological intracranial calcification in Nepalese people.

METHOD: Prospective study was conducted in MDCT brain of 150 patients referred to Department of Radiology, Bir Hospital, NAMS. CT scan of brain was performed in 16 slice Philips Multidetector CT scan machine with continuous rotational system. Standard 5 mm X 5 mm contiguous axial sections (with automatically generated thin slice sections of 1.5 mm) were taken from the base of skull to the vertex. Hyperdense foci with attenuation value more than +90 HU were taken as calcifications. Site, size and attenuation value were noted for each calcified focus. Data entry and result analysis was done using SPSS 16.

RESULT: Total 208 foci of calcifications were seen in 150 patients with 90 males and 60 females. Age range was 3-87 years with mean age 44.3 years. Age range having maximum number of intracranial calcifications is 40-49 years which has 20% of total intracranial calcifications. The highest number of calcification was seen in pineal gland (73.3%) followed by choroid plexus (58%). Pineal calcification had mean attenuation value of 156 HU and mean size of 4.65 mm. The earliest age was 19 years for pineal calcification as well as for choroid plexus calcification to appear.

CONCLUSION: Intracranial calcification was not seen below 10 years of age in Nepalese people. The commonest physiological intracranial calcification is in pineal gland, followed by choroid plexus.

KEY WORDS: Intracranial calcification, Computed tomography, Pineal gland, Choroid plexus.

INTRODUCTION

Intracranial calcification is defined as deposition of calcium compound or any mineral within the brain substances or its linings which gives rise to hyperattenuation on Computed Tomography (CT).

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Though it is difficult to say a cut off level to distinguish calcification from other causes of hyperattenuation, foci showing +100 HU (Hounsfield Unit) or more can be safely categorized as calcification, the upper HU limit is variable depending upon the content. Acute hemorrhage is also seen hyperdense on CT but its HU value usually ranges from +60 to +90. So, for practical purpose, any intracranial hyperdense focus showing more than +90 HU can be considered as calcification.

CT is the radiological modality of choice to detect intracranial calcifications as it has significantly higher...
sensitivity than that of radiography\(^2\). It is due to lack of specific localization of calcification within brain by radiography and its inability to detect calcification with value less than +200 HU as well\(^3\). CT is superior to Magnetic Resonance Imaging(MRI) for detection and characterization of calcifications\(^4\) as MRI can neither reliably determine nor rule out intracranial calcifications. MRI findings for intracranial calcifications that are already characterized on CT are also found to be variable and non-specific\(^5\).

Intracranial calcifications are physiological and pathological. Pathological calcifications are associated with specific diseases which may have other intracranial manifestations. In contrast, physiological calcifications are not associated with any disease. They have certain distribution pattern and characteristics in terms of age of patient, site, size and attenuation. They are normally seen in pineal gland, choroid plexus, basal ganglia, dura, dentate nucleus, habenula, ligaments, vessels, arachnoid granulations and lens\(^3\). Distribution and characteristics of intracranial calcifications may vary from one population to other due to genetic as well as environmental effects. Pattern of physiological intracranial calcifications is helpful for medical practitioners to suspect any pathological process in the above mentioned organs if they appear too early or look like too different from physiological ones\(^6\).

Hence the study on pattern of physiological intracranial calcifications on CT can provide a baseline platform against which pathological calcifications can be compared. Till date, we could not find any publication on this topic in our country which encouraged us in this study.

METHOD

A prospective study of CT head done from July 1, 2015 to December 31, 2015 was carried out in Department of Radiology & Imaging, National Academy of Medical Sciences, Bir Hospital, Kathmandu Nepal. Total 150 samples were taken mainly from the patients referred to Department of Radiology & Imaging for CT scan of head. Patients with obvious intracranial pathology, traumatic and postoperative patients were excluded from the study. CT scan head was performed in 16 slice Philips Multidetector CT scan machine with continuous rotational system. Standard 5 mm X 5 mm contiguous axial sections were taken from the base of skull to the vertex. Automated thin section images (with slice thickness of 1.5 mm) were used not only to increase the sensitivity of detecting calcifications but also to reconstruct sagittal and coronal images so that calcifications could be more accurately localized. Intravenous contrast was given when indicated but non-contrast images were used for our study. Hounsfield unit measurement and bone window were used to differentiate calcifications from acute hemorrhage. Hyperdense foci with attenuation value more than +90 HU were taken as calcifications. Site, size and attenuation value were noted for each calcified focus. The organs evaluated were pineal gland, choroid plexus, basal ganglia, falx (anterior and posterior), habenula, dentate nucleus, lens and others.

Data entry and result analysis was done using SPSS 16.

RESULT

Out of 150 samples taken, 90 were males (60%) and 60 were females (40%) (Table 1). Age range was 3-87 years with mean age 44.3 years. Maximum cases were of 20 to 29 years age range with 22 males and 5 females. Age range having maximum number of intracranial calcifications is 40-49 years which has 20% of total intracranial calcifications. This is followed by age range 50-59 years and 30-39 years. No calcification was seen in 0-9 years age group. The highest number of calcification was seen in pineal gland (73.3%) (Table 3) followed by choroid plexus (58%) (Table 2). Pineal calcification had mean attenuation value of 156 HU and mean size of 4.65 mm. The most common pattern of distribution of choroid plexus calcification was bilaterally symmetrical involving body of lateral ventricles. Choroid plexus calcification had mean size of 9.92 mm and mean attenuation value of 137 HU. Occurrence of intracranial calcifications was not so common in other organs like basal ganglia (Table 4), falx, habenula and dentate nucleus. The earliest age was 19 years for pineal calcification as well as and for choroid plexus calcification to appear.

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<th>Table 1: Sex distribution</th>
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Table 3: Pineal calcification

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Table 4: Basal ganglia calcification

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DISCUSSION

Physiological intracranial calcifications are one of the most common incidental findings in CT scan of head and are not associated with any diseases. They are thought to be adaptive metabolic processes which depend on many factors, among which include the individual constitutional ground and aging.

Our study shows no intracranial calcification in the young age range of 0-9 years as in other studies. Presence of pineal calcifications in a child less than 6 years suggests neoplasm. Menon & Harinarayan observed 1% of pineal calcifications in those less than 6 years. Males started choroid plexus calcification earlier than females in this study, 10-19 years and 20-29 years respectively.
Individual calcifications were 208 from 150 patients. This is because a single patient can have multiple calcifications. Such co-existence was commonly between pineal gland and choroid plexus. Choroid plexus calcification is known to be associated with pineal gland calcification. In this study, the commonest calcifications noted were pineal gland (73.3%) followed by choroid plexus (58%). Similar finding has been shown by other studies as well. Admassie and Mekonne reported an overall incidence of normal pineal gland calcifications of 72.0% and that of choroid plexus 43.3%. Similarly, Daghghi et al observed 71% of their studied population had pineal gland calcifications while 66.2% had choroid plexus calcifications. However, a reversal of this pattern was noted by other studies like one conducted by Menon & Harinarayan. Pineal and choroid calcifications peaked at 40-49 years and 50-59 years respectively with male predominance in both.

The most common pattern of choroid plexus calcification in this study was bilaterally symmetrical involving body of lateral ventricles in 82.7% cases. Calcification was seen within third ventricle in 9.1% cases. Choroid plexus calcification was not seen in frontal and occipital horns of lateral ventricles in our study. Similar findings were seen in other studies.

Physiologic pineal calcification is more common in children than previously reported, mostly because of improving computed tomography technology. The pathogenesis of pineal gland calcifications is that the pineal gland contains several calcified concretions called acervuli (corpora arenacea). Predominantly composed of calcium and magnesium salts, corpora arenacea are numerous in old patients. In smaller number they can be present in children as well. Corpora arenacea also occur in the leptomeninges, habenular commissure and in the choroid plexus. The size of physiological pineal calcification is usually 3-5 mm and if greater than 1 cm, raises concerns for underlying tumor or arteriovenous malformation. Usually, pineal gland calcifications are in the form of cluster of amorphous, irregular densities or it may be solitary. The incidence of pineal calcification noted in this study was 73.3% of the population. Similar incidence was shown by many previous studies as well. Pineal calcification was seen in none in 0-9 years, in 2.7% in 10-19 years and the highest (20%) in 40-49 years age group. The incidence of pineal gland and choroid plexus calcifications show male predisposition in this study as in other studies. The incidence of normal pineal gland and choroid plexus calcifications were higher in males than females by 26% and 10% respectively.

Physiological intracranial calcifications in sites other than pineal and choroid plexus are not so common in our study. Out of 208 foci of calcifications among 150 cases studied, 3 basal ganglia calcifications (2%), 2 anterior falx calcifications (1.3%), 3 posterior falx calcifications (2%), 2 dentate nucleus calcifications (1.3%) and 1 habenular calcification (0.7%) were seen.

Brain calcinosis syndrome (BCS) is bilateral calcium accumulation in the brain parenchyma, most common within the basal ganglia. It is also known as basal ganglia calcification or striopallidodentate calcinosis. More than 50 reported clinical conditions have been associated with BCS, including sporadic entities and the heredofamilial conditions. Basal ganglia are supplied by perforating arteries which are prone to small vessel ischaemia with increasing age. Basal ganglia calcifications are usually punctate and are located within the globus pallidus, the head of the caudate nucleus, and the putamen and are very common in elderly population. Basal ganglia calcifications have been associated with different conditions, abnormality with calcium-phosphorus metabolism being the most of these associations. Basal ganglia calcifications incidence of 2% in our studied population is within the known range of 0.3-2.5%. Lower values up to 0.8% has been reported in other studies. The earliest basal ganglia calcification was first noted at 50-59 years of life in this study which agrees with other assertions. The presence of basal-ganglia calcifications in patients <30 years of age should prompt careful clinical evaluation to rule out another etiologies like hyperparathyroidism, hypoparathyroidism and congenital disorders like Fahr syndrome. Pathological basal ganglia calcification is due to various causes such as congenital, metabolic disorders, idiopathic, aging, neurodegenerative (Fahr syndrome, Cockayne syndrome), infectious (cytomegalovirus, toxoplasmosis) and genetic disorders, birth anoxia, radiation, lead and carbon monoxide poisoning and others. Hypoparathyroidism and pseudohypoparathyroidism are the most common causes of pathological basal ganglia calcification. Before CT, 70% to 80% of brain calcification detected on plain skull radiography was associated with hypoparathyroidism.
CONCLUSION

Intracranial calcification was not seen below 10 years of age in Nepalese people. The commonest physiological intracranial calcification is in pineal gland, followed by choroid plexus. Both calcifications started at 10-19 years age range with male predominance. Average size and attenuation value of pineal calcification are 4.6 mm and 156 HU respectively. The most common pattern of choroid plexus calcification is bilaterally symmetrical involving bodies of lateral ventricles. No calcification is seen within frontal and occipital horns of lateral ventricles.

IMAGE GALLERY

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Department of Neumedicine and Department of Neurosurgery, Bir Hospital, NAMS

REFERENCES