Minimum-intensity projection images in high-resolution computed tomography lung: Technology update

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ABSTRACT

Chest physicians need to be aware about MinIP images, as these are increasingly being used for the evaluation of a wide range of lung diseases in HRCT study of lungs. MinIP images highlight the areas with reduced CT attenuation in the lung parenchyma. This allows prompt and early diagnosis of cystic lung diseases or airway, vascular or parenchymal disorders, which manifest with hypoattenuation, mosaic attenuation or air trapping. MiniP images are therefore useful for accurate pre-operative planning and disease monitoring.

KEY WORDS: HRCT Lung, Minimum Intensity Projection, MiniP images

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With increasing use of multidetector computed tomography (MDCT) in recent times, volume data can be acquired from the area of interest with high spatial and temporal resolution. One of the greatest advantages of MDCT is that the volumetric data acquired by scanning a patient can be manipulated by the computer workstations to create and display images in various ways. Apart from reconstructions in different planes, one can obtain a variety of images using their average-, low-, or high-density values. In this way, an array of images can be created for better delineation of the regional anatomy and better understanding of the disease process. Advances in imaging technology enable a wide range of postprocessing tools which generate different image types from the same data so as to highlight the region of interest in the desired algorithm.[1]

Minimum-intensity projection (MinIP) images are multiplanar slab images produced by displaying only the lowest attenuation value encountered along a ray cast through an object toward the viewer's eye. It is a data visualization method that enables detection of low-density structures in a given volume. The algorithm uses all the data in a volume of interest to generate a single bidimensional image and projects the voxel with the lowest attenuation value. The MinIP algorithm is otherwise almost identical to the maximum-intensity projection algorithm used in angiographic processing, whereby maximum attenuation voxels are projected. MinIP creates images by choosing only the lowest tissue density, that is, density equal to or closest to air. Thus, the airways and air-filled lungs are highlighted for better analysis.

MinIP in high-resolution computed tomography (HRCT) lungs is particularly useful as a wide range of lung diseases present with reduced computed tomography (CT) attenuation values. The contrast differences between normal- and low-attenuation lung parenchyma in patients with constrictive obliterative bronchiolitis may be extremely subtle on inspiratory HRCT images and MinIP improves the conspicuity of subtle changes in density of the lung parenchyma. MinIP images showed a good correlation with pulmonary function tests and

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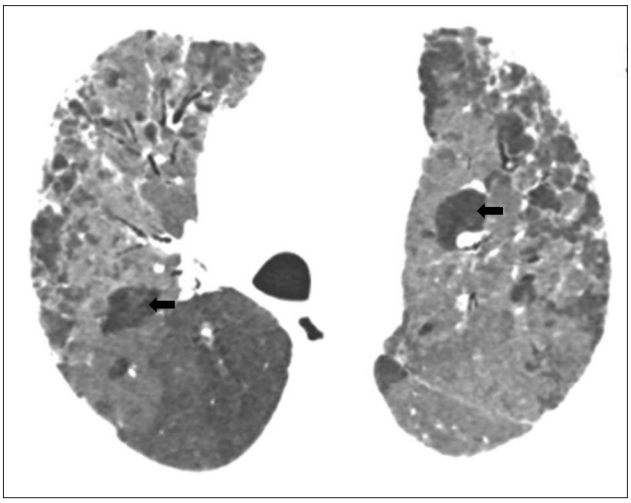

Figure 1: Minimum-intensity projection images of high-resolution computed tomography lungs in transverse plane showing extensive areas of hypoattenuation (arrows) in this patient with airway disease. The areas of hypoattenuation signify air trapping

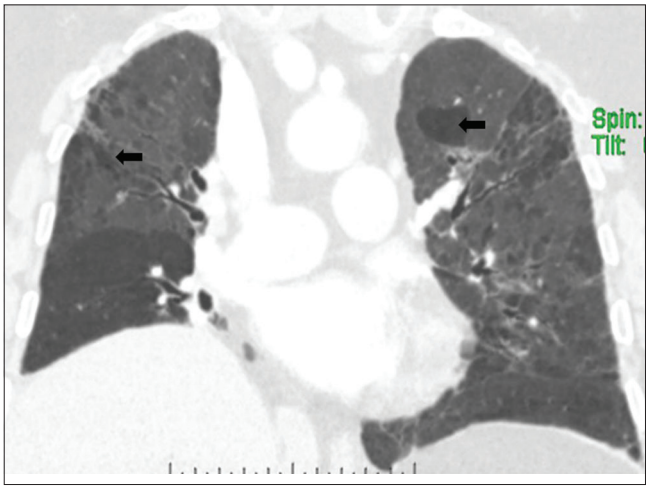

Figure 2: Minimum-intensity projection images of high-resolution computed tomography lungs in coronal plane showing extensive areas of hypoattenuation (arrows) in this patient with airway disease. The areas of hypoattenuation signify air trapping

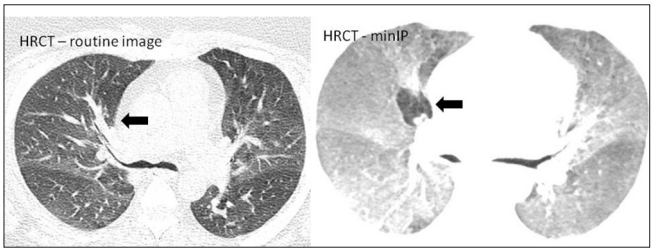

Figure 3: Comparative routine and minimum-intensity projection images of high-resolution computed tomography lungs in transverse plane showing areas of hypoattenuation (arrows) in this patient with airway disease. The areas of hypoattenuation are more conspicuous on minimum-intensity projection image

had the lowest observer variation when compared with inspiratory and expiratory images.[2,3] The acquisition of thin contiguous images (1–1.5 mm) is a prerequisite for producing MinIP images as the sliding thin-slab method offers better results with MinIP images in the evaluation of emphysema. Sliding thin-slab, MinIP images improved conspicuity of small areas of hypoattenuation.[4,5] A study reported significant difference in sensitivity of thin-section CT (62%) and sliding thin-slab, MinIP technique (81%) with similar specificity in the diagnosis of emphysema.[4] Emphysema was easier to detect on 8-mm-thick slabs because of better suppression of vascular structures. MinIP slabs should be interpreted with window widths of 350–500 HU and a window level of −750 to −900 HU.

MinIP images of lung may be generated from the HRCT data for detailed evaluation of the lung parenchyma and the bronchial tree in different imaging planes [Figures 1 and 2]. MinIP sequence allows detection of subtle areas of hypoattenuation on HRCT images secondary to air trapping [Figure 3]. This allows prompt and early diagnosis of cystic lung diseases or airway, vascular, or parenchymal disorders, which manifest with hypoattenuation, mosaic attenuation, or air trapping. Precise delineation of these foci helps in accurate preoperative planning and disease monitoring. The technique is useful in patients with chronic obstructive airway diseases, hypersensitivity pneumonia, and interstitial lung disease and is particularly useful in distinguishing traction bronchiectasis from honeycombing.[6] MinIPs are well suited because they suppress the anatomic background (vessels) and only display the lung parenchyma and dilated bronchi.

It is, therefore, important for the clinicians to be aware about MinIP images in HRCT lung, as they are increasingly being used for the evaluation of a wide range of lung diseases.

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Conflicts of interest

There are no conflicts of interest.

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