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INTERSTITIAL LUNG DISEASE BY COMPUTED TOMOGRAPHY: ULTRA LOW DOSE ASSESSMENT

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Abstract: The pulmonary interstitium comprises the space that contains the connective tissue supporting the parenchyma, as well as the lymphatic network and veins. There are more than one hundred and eighty (180) diseases that can be included in the group of DIPs. Traditionally, they are classified into two large groups: known etiology and unknown etiology. In recent years, several studies have highlighted the value of Computed Tomography in the evaluation of interstitial lung diseases. Recently a beam-shaping energy filter (Silver Beam), which takes advantage of the photon attenuation properties of silver to selectively remove low-energy photons from a polychromatic X-ray beam, has been introduced onto the global clinical stage. The beam shaping energy filter (Silver Beam) proved to be of great value in the clinical routine in chest tomography in patients who have some type of ILD. The use of technology provided high diagnostic quality images, low noise and a considerable reduction in radiation dose when compared to the standard institutional protocol.
Keywords: Chest; tomography; low dose; interstitial

INTRODUCTION

The pulmonary interstitium comprises the space that contains the connective tissue supporting the parenchyma, as well as the lymphatic network and veins (1). Additionally, it can be didactically divided into axial (central), parenchymal and peripheral. Interstitial lung disease (ILD) is a term that brings together several clinical entities that involve this interstitial space and that share different levels of inflammation and fibrosis. They are uncommon clinical entities, although they can lead to very limiting conditions (2). It is worth adding that the diagnosis and, above all, the evolutionary control of these diseases involves computed tomography (CT).

There are more than one hundred and eighty (180) diseases that can be included in the group of DIPs. Traditionally, they are classified into two large groups: known etiology and unknown etiology. Although the former is the most numerous, the latter are more frequent in clinical practice (3).

In recent years, several studies have highlighted the value of Computed Tomography (CT) in the evaluation of interstitial lung diseases. The evolution of multidetector equipment technology has made it possible to evaluate the entire chest with thin cuts and smaller spacing between cuts, without increasing the exam time (4).

This equipment allows multiplanar reconstructions of excellent quality to be performed, enabling an even more detailed assessment of the distribution of the disease throughout the bronchi, lymphatic pathways and within the secondary lobe (5).

Recently a beam-shaping energy filter (Silver Beam), which takes advantage of the photon attenuation properties of silver to selectively remove low-energy photons from a polychromatic X-ray beam, has been introduced onto the global clinical stage.

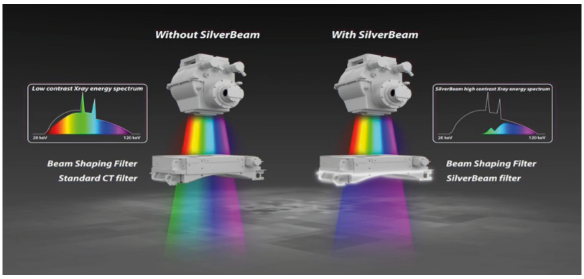

Figure 1: Silver filter. Removal of low energy photons.

This way and with its use, there is a better optimized energy spectrum for chest examinations, with radiation levels at minimum doses (ultra-low dose). Designed to work in combination with the Deep Learning AiCE (Advanced intelligent Clear-IQ Engine) reconstructor, Silver Beam offers improved

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tomographic acquisitions, enabling high quality, low noise and images with radiation levels similar to an X-ray exam.

The objective of this work was to evaluate the performance of Silver Beam in dose reduction and image quality in patients with interstitial lung diseases undergoing chest tomography.

ACQUISITION PROTOCOL

Chest tomography scans were performed on a 320-channel tomograph with 640 slices (Aquilion One Prism - Canon Tokyo, Japan). Helical acquisition, 512x512 matrix, 320 – 500 mm FOV, 0.5 mm slice thickness, 0.275 second tube rotation, 120 kV and dose modulation. The images were reconstructed with the AiCE Deep Learning reconstruction algorithm.

RESULTS AND DISCUSSION

The use of Silver Beam for lung screening and monitoring provided tomographic images of the lung with high quality and low noise. The improvement contained in the algorithm due to artificial intelligence (AI) resulted in a radiation dose on the order of a typical chest x-ray examination.

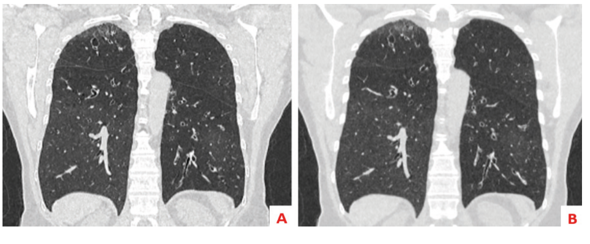

Figure 2: Chest tomography images with bronchiectasis. Image A performed with standard tomographic technique and total dose of 126 mGy (1.7 mSv – K 0.014). Image B shows acquisition performed with Silver Beam, at a total dose of 17.10 mGy (0.2 mSv – K 0.014). Eight times less radiation dose with the use of the silver filter.

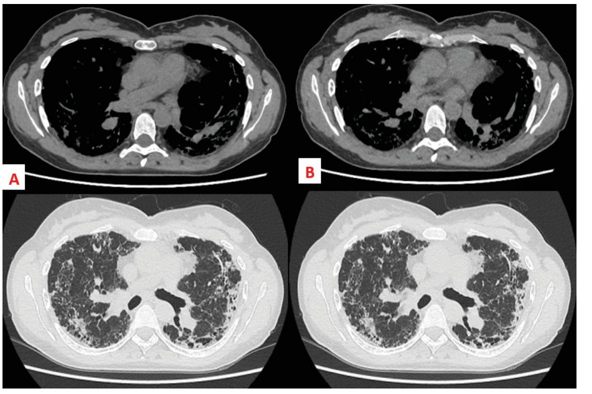

Figure 3: Tomographic images showing in detail chronic fibrosing interstitial pneumopathy (patient diagnosed with Pulmonary Fibrosis). Image A with standard technique and total dose of 121 mGy (1.6 mSv – K 0.014). Image B shows acquisition performed with Silver Beam, with a dose of 15.40 mGy (0.2 mSv – K 0.014). Even with a dose eight times lower, image B demonstrates a noise level very similar to image A.

Protocols with lower radiation doses and excellent image quality are increasingly essential in the clinical routine of diagnostic imaging centers. The advancement of technology, combined with the resources of artificial intelligence, has contributed significantly to an accurate and increasingly safer diagnosis for patients.

The results obtained allowed us to verify an excellent dose reduction between the radiation values obtained (8 times lower) from an acquisition with standard parameters and acquisition carried out with Silver Beam.

CONCLUSION

The beam shaping energy filter (Silver Beam) proved to be of great value in the clinical routine in chest tomography in patients who have some type of ILD. The use of technology provided high diagnostic quality images, low noise and a considerable reduction in radiation dose when compared to the standard institutional protocol.

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