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Radiological Correlation Between Interstitial Lung Disease and Thoracic Osteophytosis: A Review of the Evidence in Literature

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Abstract

The main purpose of this article is to provide an extensive review of the literature about cervico-thoracic marginal osteophytosis with pathophysiological, histological evidence and complications emerging from the reported literature (esophageal perforation, spontaneous intracranial hypotension (SIH), dysphagia, dyspnea etc.); and to correlate the alterations present in 5 cases reported by our centre with reported images and prevalence of radiological patterns found. The iconographic description is taken from the images that have been archived respecting the rules on privacy and before publishing them the informed consent of the patient was obtained and signed.

Keywords: ***osteophytes, interstitial, lung, disease, osteophytosis, central, marginal***

Introduction

Osteophytosis is the term for the formation of osteophytes in the bones of our skeleton. Osteophytes, also known as bone spurs, are beak-shaped bone outgrowths that form in the bones as a result of chronic degenerative processes and mainly affect the large joints, i.e., the knee, hip and vertebral discs. Two different types of osteophytosis are classically distinguished: central osteophytosis: osteophytes oriented towards the inside of the joint and marginal osteophytosis: osteophytes oriented towards the outside of the joint. The marginal osteophytes can develop at the periphery or margin of any joint and vertebral column, while central osteophytes are more common at the hip and knee. In total, 80 % of men and more than 60 % of women 50 years of age or older are said to have this change. Moreover, thoracic osteophytosis did not occur in the area adjacent to the aorta on a chest CT [1]. IPF (idiopathic pulmonary fibrosis), is a specific form of pneumonia chronic, progressive fibrosing interstitial of unknown etiology. It occurs mainly in older adults, is limited to the lungs, and is defined by the histopathological and/or radiological pattern histopathological and/or radiological pattern of UIP.

It should be considered in all adult's patients with chronic exertional dyspnoea unexplained, coughing, inspiratory bibasal crackles and/or digital hippocratism presenting without constitutional or other symptoms suggesting multisystem disease The diagnostic approach to IPF is highly dependent on images of the lungs generated by volumetric chest scanning. The radiological classification involves the use of four categories diagnostics that incorporate HRCT features and are distinguished into: a 'UIP (usual interstitial pneumonia) pattern', a 'probable UIP pattern', an 'undetermined pattern'; and 'alternative diagnosis' [2]. In the retrospective work of Rika Yoshida et al. [3] it was seen that in 40% of the 25 patients examined with HRCT, this alteration was present and the presence of pulmonary opacities, was significantly associated with thickness of osteophytes (MannWhitney U test, $P < 0.05$); and these interstitial opacities should not be considered a preclinical form of fibrosing lung disease. The phenomenon of fibrosis adjacent to spinal osteophytes in older individuals is seen as localized ground-glass opacity or a reticular pattern adjacent to osteoarthritis protrusions and is easily recognized. Other original report was trying to understand whether osteophytes of the thoracic vertebrae caused focal fibrosis in the subpleural region. the study investigators evaluated the relationship between focal interstitial opacity, osteophyte, and patient age; examined the reversibility of the change by imaging the patient in the prone position; and correlated CT findings with histology in postmortem cases. The conclusions of Otake et al [4], were that there was a strong presence of post-mortem thoracic anterior marginal osteophytosis in all

patients, it was classified into two radiological patterns: reticular and linear. The incidence of focal interstitial opacities increased with the thickness of the osteophytes. To assess the age estimation from the degree of osteophyte formation of vertebral column, we set grading scores from 0 to 3 for the osteophyte formation based on the height of the process of vertebral column and defined the average of the values at the cervical, thoracic, and lumbar parts of the vertebra to be 'osteophyte formation index' for an individual [5]. Marginal cervico-thoracic osteophytosis is predominantly asymptomatic, but in a small percentage of subjects, major (albeit rare) symptoms may be found, characterised by dysphagia, dyspnoea, oesophageal rupture, dysphonia and sometimes impairment of the trachea and upper airways [6].

Material and methods

In this section of the article, we report the presence of 5 series of image cases (figure 1 from panels A to E), which became aware of the ECORAD radiological study from September 2022 to January 2023 with clinical suspicion of pulmonary fibrosis. All patients reported symptoms of dyspnoea that could not be explained by other pathological causes. They carried out c / o the clinic "La Madonnina" pneumological examination and global spirometry with broncho reversibility test, with evidence of prevalence of restrictive pathology in the absence of alterations of lung volumes. The cases under examination are represented by men aged between 50- and 70-years non-smoking, non-pharmacoallergies, systemic arterial hypertension and reported episodes of arthritis and herniated discs in history. They were directed to perform high-resolution chest CT with prone and expiratory scans, which did not document fibrotic alterations from IPF but marginal osteophytosis with isolated focal fibrotic areas. In panel A it is possible to see the presence of multiple marginal osteophytosis of the thoracolumbar somas without evident radiological alterations. In panel B there is instead the presence of minimal areas of ground glass opacity at the expense of the pulmonary parenchyma. In panel C the spouts of osteophytes compress the pulmonary parenchyma with air trapping phenomena and distortion of the parenchymal radiological architecture and areas of ground glass opacity. In panel D axial section, you can see a radiological alteration that simulates a picture of pulmonary fibrosis. In panel E sagittal section like the previous panels from A to C, you can see the presence of an osteophyte spout that determines a bronchiolectasia visible by the red arrow. In one case out of 5 it is possible to see (figure 1 panel E) the presence of bronchiolectasia secondary to osteophytosis; which caused the patient to have diurnal symptoms (poorly productive cough and dyspnea). The radiological characteristic of these lesions is that, in relation to what is reported on this review of the literature, they have not undergone substantial changes to the 6-month follow-up over time.

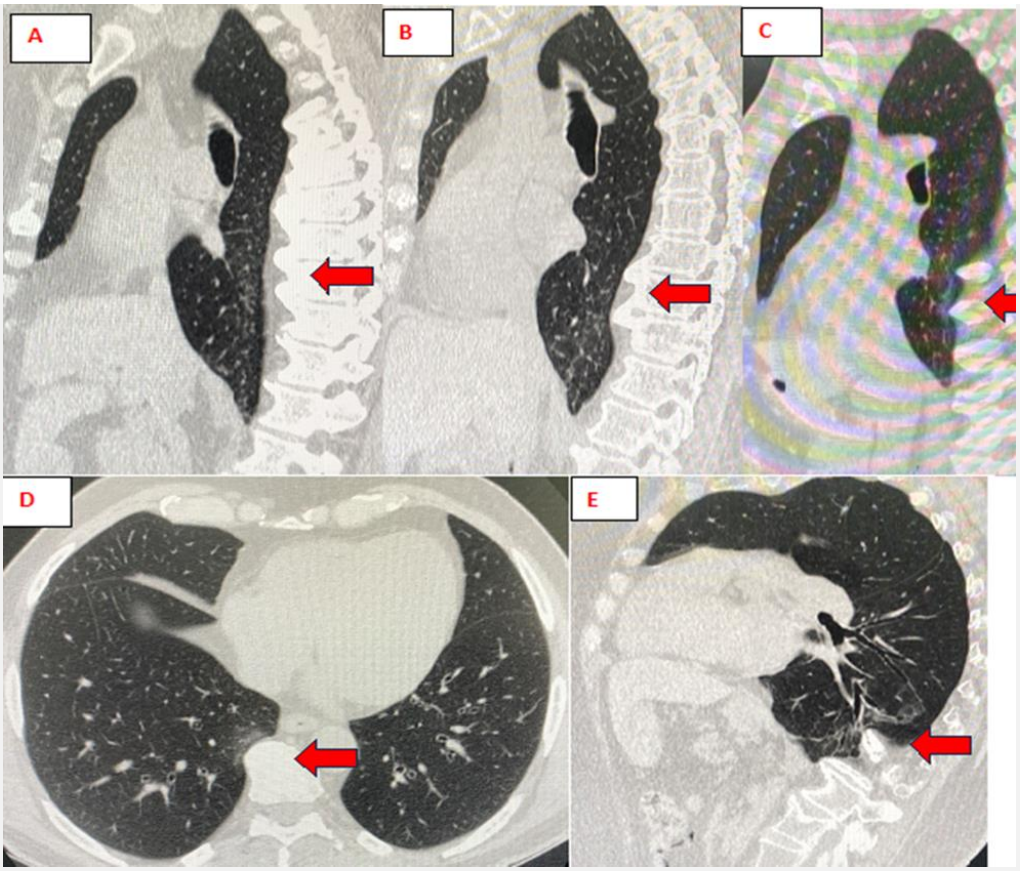

Figure 1: A-B-C-D-E: Axial and sagittal HRTC scans that highlight thoracic osteophytosis changes that result in focal areas of fibrosis in the absence of other IPF-characteristic alterations. As can be seen from panel D and E, in the areas affected by osteophytosis there are focal areas of fibrosis with reticular pattern associated in some cases with bronchioloectasis as visible from the red arrows.

Discussion

The thoracic osteophyte is mainly located on the right side of the chest, for a matter of localization near the aorta [7]. The presence of these alterations compressing the sympathetic structures in the thorax in 65% of patients that need surgical approach [8].

There are radiological algorithms to identify osteophytes also on radiography, which allow to differentiate and understand how the shape of the vertebra varies according to age and radiographic finding, The four size-invariant features used for detecting anterior osteophytes include: (1) the ratio of the vertebral area to the convex hull area, (2) the ratio of the exclusive-OR area to the convex hull area, (3) the ratio of the exclusive-OR area on the

vertebra's anterior side to the vertebra area and (4) the ratio of the area of the largest connected region from the exclusive-OR regions on the anterior side of the vertebra to the vertebra area [9]. In some case reports described in the literature, atelectasis alterations of the lung with giant bronchiolectasis formations are also present and these situation are important for patients, because of reduced lung capacity [10]. There are several studies in the literature that describe a correlation between the reduction of lung volumes and the risk of exacerbation of chronic obstructive pulmonary diseases, but one of the most recent called GERDAS, correlates the reduction of lung function, lung volumes and ACT score in reflux asthma and makes it clear how there is a close relationship between chronic obstructive diseases and the reduction of lung volumes. [11] In the literature, prospective observational studies have also been published that allow us to understand how an important role in restrictive fibrotic diseases and obstructive lung diseases is played by pulmonary rehabilitation, as improvements in mMRC scale, EuroQoL questionnaire, Barthel scale and 6-minute walking distance. Pulmonary rehabilitation appears to improve exercise tolerance, dyspnea, and quality of life [12]. Therefore it is important to direct these patients described in the review towards a rehabilitation path on the spine, to implement lung volumes and reduce the risk of exacerbation of obstructive pathology where it is present. There is only one rare case in the literature of a giant osteophytic lesion in which 3-4 osteophytic vertebral elements fuse to create a mass that needs surgery [13]. In these cases of finding multiple thoracic marginal osteophytosis, which sometimes simulates an anterior mediastinal mass on chest X-ray/CT, there is a strong respiratory impairment [14]. There is another one case report reported where there is a giant growth of osteophytes in anterior surface of thoracic spine that compress the greater splanchnic nerve and need surgical decompression with improves of symptoms [15]. There are also cases in the literature of spontaneous intracranial hypotension (SIH) due to proliferation of osteophytes in the anterior thoracic site with development of important neurological symptoms such as: postural headache subdural hematoma and neurological cognitive impairment [16]. In the cases reported in the literature, the treatment of hypotension was in most cases conservative with a partial and progressive clinical remission after at least 6 weeks of drug therapy and epidural patches [17]. There is a strong correlation between advanced age, osteoarthritis, and the development of cervical and thoracic osteophytosis, which in some cases can also determine the traumatic or non-traumatic rupture of pseudoaneurysms of the thoracic aorta, sometimes also ab ingestis pneumonia due to acid reflux microaspiration determined by compression of osteophytes on the main bronchial structures with high risk of exacerbations as reported by literature [18]. Anterior osteophytes can occasionally impinge on the anteriorly located esophagus and can cause dysphagia. This commonly involves the hypopharynx or the cervical esophagus and displaced without compression posterior mediastinum [19]. There is also the possibility of seeing in some very rare cases the presence of osteophytes in endoscopy, as reported by a case report in the literature of esophageal perforation found endoscopically [20].

Conclusion

In the literature, there are very few cases of thoracic marginal osteophytosis leading to lung involvement. most of the literature, is represented by case reports/case series, only two retrospective papers correlating the presence of thoracic marginal osteophytosis with the radiological finding of focal areas of opacity. Histopathological, these fibrotic changes have been explained by mechanical compression by the osteophyte causing focal fibrosis in the adjacent lung tissue. The protrusion of the osteophyte can also cause the subpleural alveolar space to collapse chronically and the formation of collagen and elastic fibers in the interalveolar septa. Rarely from what can be deduced from the literature reported, osteophytosis gives symptoms, but when it is present, it means that compression on the air and mediastinal structures is so important that in some cases it also gives esophageal rupture and perforation. The supporting data do not allow to clarify whether there is a clear fibrotic evolution of fibrotic damage caused by osteophytes, however further prospective and radiological studies will be necessary to demonstrate this radiological evolution over time.

Declarations

Ethical Considerations, informed consent, and Consent for publication

Informed consent was signed by all study participants. All mentioned ethical aspects and related consents were taken into consideration during the conduct of this study.

Contributions

MUS helped in conception and design of the study, MUS and URP did data collection, AC and SD did analysis and interpretation of data; KRS and LAVD contributed to drafting the work and revising it critically for important intellectual content. All authors approved the final version for publication and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of interest

The authors declare they have no competing interests, and all authors confirm accuracy.

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None

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Case series with mini review of literature

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