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Evaluating spine ankylosis, vertebral fractures and bone fragility on a single CT-scan in patients with ankylosing spondylitis: myth or reality?

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Introduction

Spine ankylosis: factor related to osteoporosis in ankylosing spondylitis (AS) associated with higher risks of vertebral fracture (VF) and morbi-mortality.¹

Screening for osteoporosis: based on DXA assessment but presence of artifacts (syndesmophytes, bone bridges and vascular calcification).

Bone fragility can be diagnosed by computed tomography (CT) through the measurement of the scanographic bone attenuation coefficient of the first lumbar vertebra (SBAC-L1).^{2,3}

➤ SBAC-L1 allows estimation of the trabecular bone density of the L1 vertebra without artifact.

Pickhardt et al. reported that an SBAC-L1 ≤ 145 HU (Hounsfield Units) identified 96.6% of patients with VF, compared with only 39% identified by DXA in overall population.³

Objectives

➤ To assess the association between the SBAC-L1, a marker of bone fragility and spine structural lesions on CT, in AS patients

➤ To determine both VF prevalence and the percentage of patients under the fracture threshold (SBAC-L1 ≤ 145 HU).

Patients & Methods

Of 1503 SpA patients followed from 2009 to 2017 at Nancy University Hospital, all patients who met the New York criteria and had a TAP-CT and X-rays (spine, pelvis) within the previous 2 years were included.

CT spine structural lesions were scored: erosions, syndesmophytes and ankylosis for the anterior and posterior parts of the disco-vertebral unit from the C7 to S1 vertebrae. The anterior, posterior and total (anterior+posterior) ankylosing CT spine scores (ACTASSS) were calculated. (Figure 1)

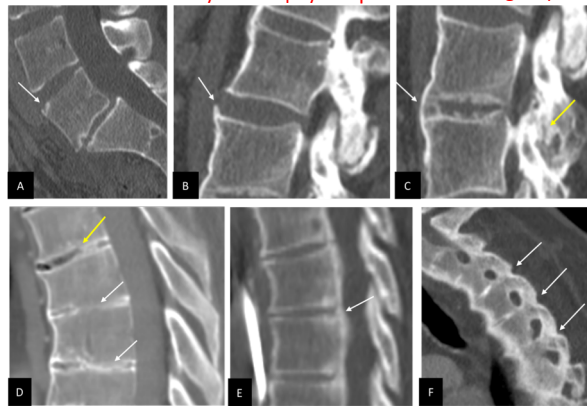
Patients & Methods

SBAC-L1: performed on L1 axial sections through the pedicles on the bone window. SBAC-L1 ≤ 145 HU defined the fracture threshold. (Figure 2)

Presence of VF, their grades and localizations were studied on sagittal sections (bone window) of the thoracolumbar spine using an adaptation of Genant's classification for radiography (Figure 3).

Spine structural assessment on CT scans

erosion: 1pt syndesmophyte: 2pt bone bridge: 6pt



intervertebral disc ankylosis: 6pt bone bridge: 6pt ankylosis of facet joints: 6pt

Anterior ACTASSS: most severe structural lesion of the 4 vertebrae corners for each DVu (C7 inferior to S1 superior)

Posterior ACTASSS: Ankylosis or not of the facet joints for each DVu (C7 to S1)

Total ACTASSS: sum of anterior + posterior ACTASSS

VF evaluation on CT scans

mild VF moderate VF severe VF



severe transdiscal fracture

interspinous posterior fracture

SBAC-L1

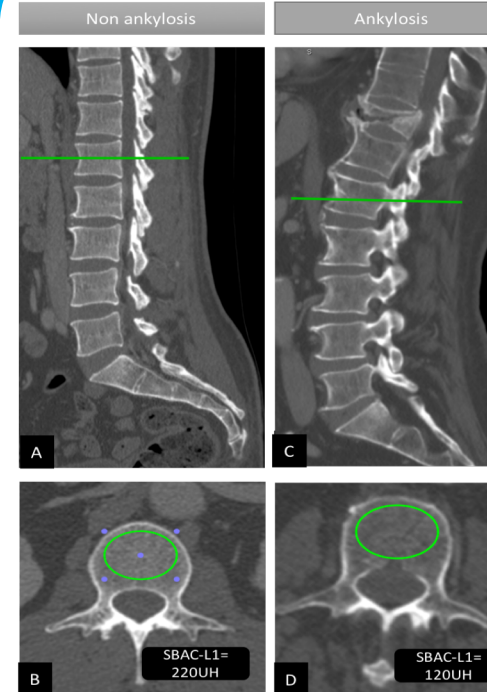


Figure 2:

A. Non-ankylosed spine: The largest elliptical region of interest (ROI) was drawn on the trabecular bone of L1 vertebra with a SBAC-L1 measurement at 220 HU.

C. Ankylosed spine: SBAC-L1 measurement at 120 HU.

Results

- 67 AS patients included: median age: 61.2 years, 89% men, 63.5% HLA-B27 +, 100% sacroiliitis on X-ray
- Mean anterior, posterior and total ACTASSS: 32.4 (±39.9), 27 (±40.9) and 63.7 (±82), respectively. Mean SBAC-L1: 135.7 HU (±49.2).
- **SBAC-L1 and ACTASSS inversely correlated (r= -0.40; p<0.01).**
- **Ankylosed AS patients had more frequently a SBAC-L1 ≤ 145 HU (p<0.012).**
- Spine ankylosis on CT in 38 patients (56.7%): 49.2% and 46.3% with anterior and posterior vertebral ankylosis respectively.
- **40 patients (59.7%) under the fracture threshold (SBAC-L1 ≤ 145 HU).**
- 9 VFs on CT in 5 patients (**prevalence of 7.5%**): 4 patients under the fracture threshold and 3 with spine ankylosis.
- SBAC-L1 and ACTASSS were highly reproducible.
- **The agreement between mSASSS and anterior ACTASSS for the diagnosis of syndesmophytes was 68%.**

Conclusion

- ✓ **Opportunistic TAP CT could be a complement to radiography to evaluate spine structural lesions, bone fragility through SBAC-L1, and VF in AS.**
- ✓ **AS patients rarely investigated for osteoporosis by DXA (26.8%). Using SBAC-L1, when CT-scan has already been performed, offers an alternative osteoporosis screening method.**

References

1. Malochet-Guinamad S, et al. BMC Musculoskelet Disord. 2017;18(1):357
2. Perrier-Cornet J, et al. Osteoporos Int. 2019;
3. Pickhardt PJ, et al. Ann Intern Med. 2013;158(8):588-95.