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## ORIGINAL ARTICLE

# The prevalence of osteoarthritis of the sternoclavicular joint on computed tomography

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**Background:** Symptomatic disorders around the sternoclavicular joint (SCJ) are relatively uncommon. Previous cadaveric and radiographic studies have suggested that asymptomatic osteoarthritic changes are relatively common, progressively increasing with age. The purpose of this study was to determine the prevalence of SCJ osteoarthritis in the general population using computed tomography (CT) scans.

**Methods:** We assessed 464 SCJs in 232 patients undergoing a standardized axial CT scan of the thorax including both SCJs, across a range of ages from the second to tenth decade. The scans were undertaken for multiple clinical indications; however, none were obtained to investigate SCJ pathology. The predominant changes investigated were for the features associated with osteoarthritis including the presence of osteophytes, subchondral cysts, and subcortical sclerosis.

**Results:** The CT scans of 244 SCJs (53%) in 137 patients (59%) showed at least 1 sign of osteoarthritis. No patients younger than 35 years had any features of osteoarthritis. Osteoarthritic changes were present in 89.6% of patients older than 50 years compared with 9.1% younger than this age. All patients above the age of 61 had at least 1 feature of osteoarthritic changes on at least 1 side of the SCJ. Increasing prevalence was noted with increasing age both in the percentage of SCJs showing any positive signs of osteoarthritis and in the severity of osteoarthritis.

**Conclusion:** SCJ osteoarthritis is a very common incidental finding on CT scans, particularly with increasing age. This should be taken into consideration when using a CT scan to assess a patient with symptomatic SCJ pathology.

**Level of evidence:** Level III; Cross-Sectional Design; Epidemiology Study

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**Keywords:** Sternoclavicular joint; osteoarthritis; computed tomography; prevalence; age; cysts; osteophytes; sclerosis

Institutional Review Board approval was not required for this study in the United Kingdom.

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The sternoclavicular joint (SCJ) is the sole synovial articulation between the upper limb and the axial skeleton. Disorders around the joint in the form of degenerative and inflammatory arthritides, infection, and trauma do occur but tend to be treated nonoperatively because they are generally well tolerated.<sup>10</sup> However, in those situations in which the disorder is poorly

tolerated, the decision to manage nonoperatively is made in part because of concerns associated with the risks of surgery around the SCJ, as well as the previous diagnostic limitations associated with plain radiography. Advances in surgical techniques, particularly in the management of osteoarthritis (OA),<sup>13</sup> and greater access to computed tomography (CT) scans and other imaging modalities have led to increased interest in pathology around the SCJ.

Although often asymptomatic, the most common disorder affecting the SCJ is OA.<sup>4</sup> Previous studies looking at the prevalence of SCJ OA have been cadaver based at a microscopic level and radiographic using plain radiographs.<sup>7,11</sup> Both suggested that the onset of OA changes commenced in the third decade of life and that the majority of persons older than 60 years were affected. Although a common incidental finding, the prevalence of OA of the SCJ seen on routine CT scans has not previously been assessed.

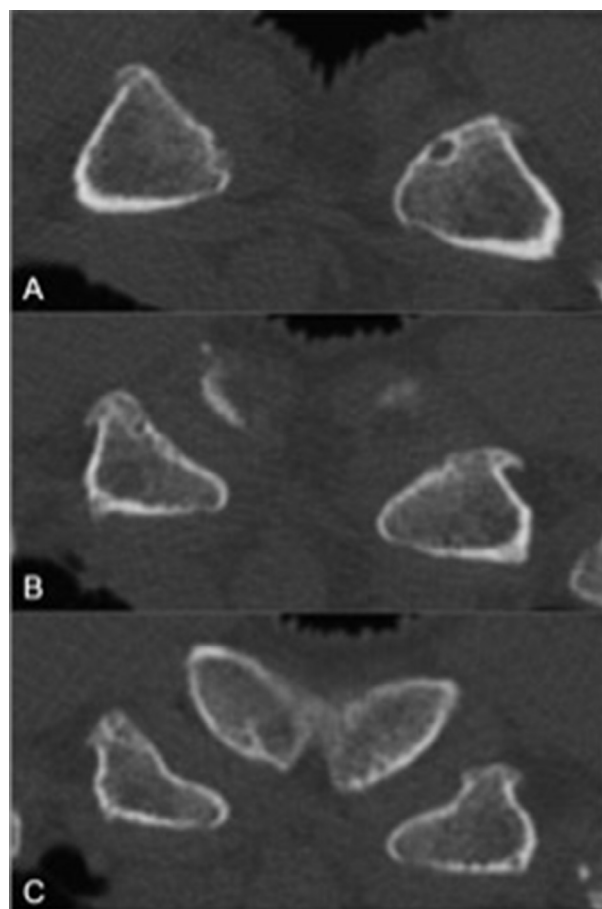
We assessed a large group of SCJ CT scans of patients ranging from the second to the tenth decade of life for changes associated with OA to determine the age-related prevalence. This allowed us to determine whether the degenerative findings on CT scans had a similar age-related distribution to the previous cadaver-based studies, as well as to assess the incidence of hypertrophic OA changes.

## Materials and methods

The online radiology database at our hospital was searched for CT imaging of the thorax. The routine axial sequences included the neck and whole chest, and therefore fine cuts of the SCJ were routinely available. The images were adjusted to the bone window and enlarged to twice standard zoom on a consistent viewing screen. Each CT scan had a maximum slice thickness of 2 mm, leading to a minimum number of 18 slices through each joint, extending from the most cranial part of the clavicular articular surface to the most caudal part of the sternal articular surface. The patients' position within the scanner and whether their arms were by their side or above their head were determined not to have an impact on the assessment because the reporting was based on the presence or absence of findings on the 2-mm slice and not based on the distribution of changes at the joint.

The CT scans were undertaken for a number of indications, including for diagnosis and staging of carcinoma, for investigation of various lung diseases, for investigation of infections, as part of a routine trauma series, and for various other reasons such as renal failure, upper gastrointestinal investigations, and autoimmune disease. None of the scans were undertaken to assess any SCJ or chest wall conditions. A range of ages was searched for and actively assessed to achieve a minimum of 20 patients or 40 SCJs in each 10-year age period from the second decade to the tenth decade. The selection of scans was based on type of scan and age only, with the analysis performed once the scan had been selected.

The changes assessed for were the presence of radiologic features that are associated with OA.<sup>6</sup> These were osteophyte formation, subchondral cysts, and cortical sclerosis. Because of the concavoconvex shape of the SCJ and the difficulty in obtaining symmetrical alignment of the joints, joint space narrowing has been shown to



**Figure 1** (A-C) Selection of images from a series of axial computed tomography slices from cranial (A) to caudal (C) displaying medial clavicle osteophytes, sternal sclerosis, and subchondral cysts.

be an inaccurate measure in CT assessment and so was not included.<sup>2</sup> Each scan was reviewed independently by 3 assessors (a post-FRCS orthopedic senior trainee [C.R.L.], a senior shoulder fellow [B.E.], and a consultant shoulder surgeon [G.M.T.-S.]) with the presence or absence of an OA change determined by a majority finding.

The sex of the patient was recorded, and the clavicular and sternal sides of each SCJ were assessed separately. A score of 1 point each was given for the presence of osteophytes, the presence of subchondral cysts, and the presence of sclerosis. The number of changes on the sternal and clavicular sides of each joint was recorded, along with the total for each side (a maximum score of 6 points), as well as the total for both joints for each patient, to give a relative indication of severity of OA. For the purposes of this study, we considered the presence of an osteophyte, a cyst, or sclerosis on either side of the joint (a score of  $\geq 1$  point) to be indicative of OA (Fig. 1).

If the axial anteroposterior width of the medial end of the clavicle on one side appeared to be more than 50% larger than that on the other side with evidence of OA changes and visible overlying soft-tissue protrusion on the CT scan, we considered it to be hypertrophic. This objective observation was used to apply a definition to the findings and allow the assessor to report the findings but has not previously been used. Any additional features

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