The Prevalence of Sacroiliac Joint Degeneration in Asymptomatic Adults

Jonathan-James T. Eno, MD, Christopher R. Boone, MD, Michael J. Bellino, MD, and Julius A. Bishop, MD

Investigation performed at the Department of Orthopaedic Surgery, Stanford University School of Medicine, Stanford, California

Background: Degenerative changes of the sacroiliac joint have been implicated as a cause of lower back pain in adults. The purpose of this study was to determine the prevalence of sacroiliac joint degeneration in asymptomatic patients.

Methods: Five hundred consecutive pelvic computed tomography (CT) scans, made at a tertiary-care medical center, of patients with no history of pain in the lower back or pelvic girdle were retrospectively reviewed and analyzed for degenerative changes of the sacroiliac joint. After exclusion criteria were applied, 373 CT scans (746 sacroiliac joints) were evaluated for degenerative changes. Regression analysis was used to determine the association between age and the degree of sacroiliac joint degeneration.

Results: The prevalence of sacroiliac joint degeneration was 65.1%, with substantial degeneration occurring in 30.5% of asymptomatic subjects. The prevalence steadily increased with age, with 91% of subjects in the ninth decade of life displaying degenerative changes.

Conclusions: Radiographic evidence of sacroiliac joint degeneration is highly prevalent in the asymptomatic population and is associated with age. Caution must be exercised when attributing lower back or pelvic girdle pain to sacroiliac joint degeneration seen on imaging.

Level of Evidence: Prognostic Level IV. See Instructions for Authors for a complete description of levels of evidence.

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Lower back pain has become one of the most commonly encountered ailments in medical practice in general and in orthopaedics in particular. It is the most frequent cause of activity limitation for people younger than forty-five years, with a point prevalence of 30%, one-year prevalence of 50%, and lifetime prevalence of 80%3,4. It accounts for 3% of all emergency-room visits and $30 billion to $50 billion in health-care costs annually5,6. Sacroiliac joint disease has been implicated as a possible cause of low back pain and dysfunction, and there is increasing interest in invasive treatments ranging from analgesic and corticosteroid injections to percutaneous or open arthrodesis7-9. Traditional open sacroiliac joint arthrodesis has been utilized in the past; however, poor clinical results and high complication rates requiring additional surgery tempered enthusiasm for such procedures10. Recent advances in surgical technique, including minimally invasive sacroiliac joint arthrodesis, have led to renewed interest in surgical treatment of low back pain due to presumed sacroiliac joint pathology11. The diagnosis is typically based on symptoms, physical examination, and degenerative changes seen on computed tomography (CT) scanning.

However, the association between pain and degenerative changes on CT scans has not been established. It has long been

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known that sacroiliac joint degeneration is common\textsuperscript{11-14}. Over thirty years ago, Vogler et al. evaluated forty-five asymptomatic patients with CT scans in an attempt to distinguish radiographic markers of inflammatory sacroiliitis from normal degenerative changes of the sacroiliac joint, finding minor changes such as subchondral sclerosis or joint-space narrowing in up to 83\% of patients\textsuperscript{11}. More advanced changes, including osteophyte formation (20\%), erosions (2\%), subchondral cysts (2\%), and ankylosis (9\%), were seen less commonly\textsuperscript{11}. More recent research has revealed that radiographic abnormalities elsewhere in the lumbar spine are also highly prevalent in asymptomatic individuals. Boden et al. acquired lumbosacral magnetic resonance imaging (MRI) for sixty-seven asymptomatic patients and found that 28\% of the cohort had substantial pathological changes on MRI, including 24\% with disc herniation and 4\% with spinal stenosis\textsuperscript{15}. Similarly, Jensen et al. evaluated ninety-eight patients with no history of back pain who underwent lumbosacral MRI and found that only 36\% of the subjects had no radiographic abnormality, with the remaining 64\% showing pathological changes in at least one disc and 38\% with multilevel pathological changes\textsuperscript{16}. All of these studies found an increasing prevalence of lumbosacral abnormalities with increasing age and suggest that caution is needed when attributing low back pain to pathological changes seen on advanced imaging.

We endeavored to conduct a contemporary study similar to that of Vogler et al. but with a larger group of patients of various ages\textsuperscript{11}. The purpose of the present study was to quantify degenerative changes of the sacroiliac joint in a large cohort of asymptomatic patients evaluated with contemporary, high-resolution CT scans. We hypothesized that sacroiliac joint degeneration would be prevalent in asymptomatic individuals and that the prevalence would increase with age.

Materials and Methods

Institutional review board approval was obtained prior to the initiation of the present study. Compared with elsewhere in the axial spine where soft-tissue pathology is highly prevalent, sacroiliac joint degenerative changes are primarily osseous in nature, so CT scanning was selected as the imaging modality of choice\textsuperscript{15-18}. Five hundred consecutive scans of the pelvis made over a two-month period for reasons other than low back or pelvic girdle pain were identified from the picture archiving and communication system (PACS) at an academic tertiary-care medical center. Patients were initially excluded if the indication for the CT scan included trauma; back, hip, or pelvic pain; or the presence of open physes or any hip or spinal instrumentation. A chart review was also performed, and patients with a history of spinal stenosis; back, pelvic, or hip pain; previous spine, pelvic, or hip surgery; or a history of metastatic, inflammatory, or rheumatologic disease were identified and excluded.

All CT scans were reviewed by an attending orthopaedic surgeon specializing in pelvic surgery as well as an orthopaedic fellow, and a classification system was applied. Axial plane reformatted images were viewed in the bone window parameters with manual adjustment by the reviewer as deemed necessary. Sacroiliac joints were evaluated for joint-space narrowing, sclerosis, and osteophyte formation. Joints were classified as type 0 if there were no degenerative changes (Fig. 1); as type 1 if there were mild degenerative changes with minimal osteophyte formation, mild subchondral sclerosis, and/or subtle joint-space narrowing (Fig. 2); as type 2 if there were substantial degenerative changes including large osteophytes, substantial subchondral sclerosis, and/or definite joint-space narrowing without ankylosis (Fig. 3); and as type 3 if there was sacroiliac joint ankylosis (Fig. 4). The prevalence of degenerative changes was quantified in the overall patient population as well by decade of life. Statistical analyses in the form of linear regression models were then run to estimate the change in the odds of sacroiliac joint degeneration for each additional year of age.

Fig. 1
A type-0 sacroiliac joint has no evidence of degenerative changes.

Fig. 2
A type-1 sacroiliac joint has evidence of mild degenerative changes (mild subchondral sclerosis, minimal osteophyte formation, and subtle joint-space narrowing).
Source of Funding
No external funding was received for this study.

Results
A total of 500 pelvic CT scans were reviewed. Three hundred and seventy-three scans (746 sacroiliac joints) met the inclusion criteria and were used in the study. The indication for a CT scan included abdominal pain in 260 patients (69.7%), cancer staging or surveillance in forty-eight patients (12.9%), evaluation of an abdominal or pelvic mass in sixteen patients (4.3%), postoperative complication following abdominal surgery in eleven patients (3.0%), and other (preoperative planning,
abdominal aortic aneurysm, aortic coarctation, leukocytosis of unknown origin, or ingestion of a foreign object) in thirty-eight patients (10.2%). One hundred and eighty-one patients were male and 192 were female; the mean age was 57.7 years (range, sixteen to ninety-six years) (Fig. 5). The overall prevalence of sacroiliac joint degeneration (type 1, 2, or 3) in at least one sacroiliac joint was 65.1%, and the overall prevalence of substantial degeneration (defined as type 2 or 3) in at least one sacroiliac joint was 30.5%. Degenerative changes were also related to age (Fig. 6). In patients under the age of thirty years, only 7.1% showed mild degenerative changes and none had substantial degenerative changes. In patients who were thirty years and older, the prevalence of degenerative changes increased progressively with increasing age, with 87.6% of patients sixty years and older demonstrating some changes and 45% demonstrating substantial degenerative changes. By the ninth decade of life, 91% of subjects displayed degenerative changes.

A logistic regression model calculating the increased probability of the presence of sacroiliac joint degeneration revealed a progressive increase of 8.5% (95% confidence interval, 6.5% to 10.4%) per year of life in the odds of having sacroiliac joint degeneration. A separate logistic regression model evaluating substantial sacroiliac joint degeneration (type 2 or 3) estimated a 5.5% increase per year of life, peaking at 57.9% in the eighth decade of life.

**Discussion**

We found a high prevalence of degenerative changes in the sacroiliac joints of asymptomatic adults. Sixty-five percent of the subjects had some degenerative changes, while 30.5% had advanced degeneration or ankylosis. The prevalence of degenerative changes increased with age, and >85% of asymptomatic patients over the age of sixty had sacroiliac joint degeneration. Given the high prevalence of pain-free sacroiliac joint degeneration, physicians must be cautious in attributing low back pain to degenerative changes of the sacroiliac joint seen on cross-sectional imaging.

There are a number of limitations to this study. Although we scrutinized patient charts for any evidence of back or pelvic pain, it is possible that some patients with sacroiliac joint degeneration actually did have pain that was not reflected in their medical record. This could have led us to overestimate the prevalence of disease in the asymptomatic population. Additionally, in the absence of a previously validated classification system, we created our own for the purposes of this study, but it requires validation. Finally, we evaluated an older patient population and had only six patients under the age of twenty. Our findings therefore may not be applicable to a younger patient population. However, our series still captures a large sample of patients with no documented history of pelvic or back pain that likely represents a large cross section of the general population.

Our results are consistent with those of previous studies in the orthopaedic literature. The present study confirmed these findings while assessing many more patients across a wider age range using contemporary CT technology. Several studies have also documented the disconnect between pathological findings on imaging and symptoms in other areas of the body. Jans et al. evaluated 691 patients with clinical symptoms of sacroilitis with pelvic MRI and found that 41% of the patients showed no abnormality on imaging. In addition to the previously noted...
findings in the spine described by Boden et al. and Jensen et al.,
recent studies have also documented a very high prevalence of
asymptomatic trapeziometacarpal arthropathies in patients being seen
for a distal radial fracture.5

As has been suggested with trapeziometacarpal joint de-
generation, sacroiliac joint degeneration appears to be a normal
part of human aging for which many patients with radiographic
findings never seek treatment for pain. These observations and
the lack of universally accepted diagnostic criteria may help to
explain the ongoing controversy that surrounds the diagnosis
and treatment of suspected sacroiliac joint pain.4 Recent clinical
studies of invasive treatment of the sacroiliac joint have shown
mixed results. A systematic review of studies in which sacroiliac
joint arthrodesis was compared with denervation as well as an-
algic and corticosteroid injection found clinical improvement
in terms of pain regardless of treatment modality.2,11 However,
less than half of the patients with available data on work status
were able to return to work, and one of the included studies
revealed that 82% of the patients had marked or severe pain at
thirty-nine months after sacroiliac joint arthrodesis.6 A better
understanding of the natural history of sacroiliac joint degener-
ation provided by our study will likely help surgeons to im-
prove their clinical decision-making.

In summary, the prevalence of sacroiliac joint degenera-
tion is high in patients without a history of pain and increases
substantially with age. Because sacroiliac joint degeneration may
be found coincidentally on imaging studies made to investigate
the source of back or pelvic pain, physicians must be cautious
in attributing pain to these findings and in advocating surgical
intervention.

Jonathan James T. Eno, MD
Michael I. Bellino, MD
Julius A. Bishop, MD
Stanford Medicine Outpatient Center,
M/C 6342, 450 Broadway Street,
Redwood City, CA 94063.
E-mail address for J.-J.T. Eno: jeno@stanford.edu.
E-mail address for M.I. Bellino: michael.bellino@stanford.edu.
E-mail address for J.A. Bishop: jabishop@stanford.edu

Christopher R. Boone, MD
Bellevue Bone and Joint Physicians,
1427 116th Avenue N.E.,
Bellevue, WA 98004.
E-mail address: Boone34@gmail.com

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