The aging process in the sacroiliac joint: helical computed tomography analysis

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Abstract The purpose of this study was to compare the frequency of degenerative changes in the sacroiliac joint by age, sex, laterality, body mass index, and childbearing experience, based on computed tomography (CT) images obtained from the lower back of symptom-free subjects in different age groups. These data were used to trace the development of the sacroiliac joint until the occurrence of osteoarthritis with aging. CT transverse and coronal images were examined for the presence of the following degenerative signs: joint space narrowing, sclerosis, osteophytes, cysts, and erosion. The results indicated that joint degeneration begins in the 20s and tends to progress with age. Each form of degeneration was markedly more frequent in the 40s or older, and some type of degeneration was observed in the joints of all subjects aged 50 years or older. In terms of the localization of the joint degeneration, sclerosis was common on the upper and middle anterior of the articular surface of the ilium, and osteophytes were common on the anterior surface of the sacrum. Degeneration had progressed further in women than in men in every age group, and tended to progress faster in parous than in nulliparous women. It was presumed that the birth of the first child, rather than subsequent births had the greatest effect on the sacroiliac joint.

Key words Sacroiliac joint · Helical CT · Aging process · Degenerative change · Childbearing

Introduction

The human pelvic ring consists of a strong annular bone structure, with the two articular structures of the sacroiliac joint and the pubic symphysis. Degeneration of these binding sites with aging leads to deterioration of the pelvic ring. Because the pubic symphysis site is a synchondrosis, degeneration in itself induces no major clinical problems. Although the sacroiliac joint in the posterolateral part of the pelvic ring is a synovial joint, it may degenerate with age, possibly contributing to lower back pain.

The sacroiliac joint of a typical Japanese male is a joint with a surface area of 14.5 cm², and it resembles an auricle. It bears half of the trunk weight. In addition, the surface of the joint is not perpendicular to the trunk load axis, but faces the direction in which shearing force is exerted when an orthostatic load is applied. Because of its morphology, the sacroiliac joint may be susceptible to damage at an early stage in life, making it one probable hard-to-diagnose cause of lower back pain.

The purpose of this study was to compare the frequency of degenerative changes in the sacroiliac joint by age, sex, laterality, body mass index (BMI), and childbearing experience, based on computed tomography (CT) images obtained from the lower back of symptom-free subjects in different age groups. These data were used to trace the development of the sacroiliac joint until the occurrence of osteoarthritis with aging.

Subjects and methods

The subjects were 95 healthy Japanese adult volunteers (190 joints), who were informed of the aim of this study; none of them had any complaints in their lower back, pelvis, or hip joints. The group consisted of 47 men and 48 women between the ages of 21 and 86 years (average, 50.8 years). The subjects were classified into 10-year age groups with nearly equal numbers of male and female subjects (Fig. 1).

Transverse CT images were obtained sequentially, using an X-Vigor apparatus (Toshiba Japan, Tokyo, Japan). The images were taken nearly perpendicular to the long axis of the sacrum by scout view with a slice thickness of 5 mm. Coronal images were obtained with helical CT, using X-Tension (Toshiba), and the images
were reconstructed using multiplanar reconstruction (Fig. 2).

The transverse and coronal CT images were examined for the presence of the following degenerative signs: joint space narrowing (JSN), defined as a narrowing to less than 2 mm; sclerosis, defined as the presence of irregular zones with increased subchondral density; osteophyte surrounding the joint; cyst, defined as the presence of a radiolucent area in contact with the articular surface; and erosion with subchondral cortical destruction.

To determine the localization of degenerative findings in the sacroiliac joint, the surfaces of the sacroiliac joints were divided into three parts anteroposteriorly and three parts vertically. The frequency of degeneration in each of these nine segments was examined (Fig. 3).

To assess the stage of joint degeneration, the progress of joint degeneration was classified into the following three categories based on the results of the CT imaging: (i) normal images, i.e., images revealing no abnormality; (ii) images showing slight degeneration, i.e., images showing only JSN, or sclerosis, or osteophyte on less than one-third of the entire articular surface; and (iii) images showing severe degeneration i.e., images showing erosion, or sclerosis, or osteophyte on more than one-third of the entire articular surface.

To investigate the time of development of sacroiliac osteoarthritis, we examined possible relationships between the following six factors: age, sex, laterality, body mass index (BMI), experience and frequency of childbearing, and the presence of degenerative joints.

The analyses were performed with the statistical analysis software program Stat View (Abacus Concepts, USA). The data were tested using the t-test and $\chi^2$ test, with a level of significance of 5%.

**Fig. 1.** Age and sex distribution of study subjects (n = 95). Gray bars, Men; white bars, women

**Fig. 2a, b.** Method for computed tomography (CT) scanning of the sacroiliac joint. a Transverse images were obtained nearly perpendicular to the long axis of the sacrum. b Coronal images were obtained by helical CT, and were reconstructed using multiplanar reconstruction

**Fig. 3.** Localization of degenerative findings in the sacroiliac joint. The surface of the sacroiliac joint was divided into three parts anteroposteriorly and three parts vertically. The frequency of degeneration in each of the nine segments was examined