




Prevalence of Accessory Sacroiliac Joint and Its Clinical Significance

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ABSTRACT

Objective: To determine the prevalence of the accessory sacroiliac joint (ASIJ) on both computed tomography (CT) images and dry bones.

Methods: CT images archived in the Radiology Department of Gaziantep University Medical Faculty obtained from 145 individuals (104 males and 41 females) as well as 92 sacral bones were examined.

Results: The prevalence of ASIJ among 92 sacral bones was 15.2%. The ASIJ was more commonly (52%) located at the posterior portion of the SIJ at the level of the second dorsal sacral foramen. In 48% of the bones, ASIJ was identified just above the first dorsal sacral foramen. Unilateral ASIJ was observed in 10.8% and bilateral ASIJ in 4.4% of the sacral bones. On CT images, ASIJ was found in 7.8% of the males and 7.2% of the females. The total prevalence of sacroiliac joint variations was 28.9%, and 6.8% of them were ASIJs.

Conclusion: It should be kept in mind that ASIJ may be a source of arthritis and chronic hip pain. The presence of ASIJ should be sought through imaging studies for early diagnosis of ASIJ.

Keywords: Accessory sacroiliac joint, variation, computed tomography, dry bone

INTRODUCTION

Several anatomists have investigated accessory sacroiliac joints within the confines of the articulation area of the sacroiliac joint (SIJ) [1-8]. Since the joint space width is used in the diagnosis of SIJ pathologies, knowledge of the normal anatomic structure of the SIJ and its variations have gained importance for the radiological assessment of diseases including inflammatory sacroiliitis [9].

Accessory sacroiliac joint (ASIJ) is a common anatomical variation of the sacrum [10-13]. While this accessory joint can be found bilaterally, it is often unilateral [4-6,11]. Located at the posterior aspect of the SIJ, ASIJ has usually been described as having a superficial structure at the level of the second dorsal sacral foramen and a deep structure just above the first dorsal sacral foramen [13-18]. In a 1984 study, an axial sacroiliac joint was found to be located extracapsularly at the dorsocranial level of the SIJ. The presence of fibrocartilage was demonstrated on the articular surface in several samples. Since the axial joint was histologically identified in the joint space, it was defined as "syndesmosis" due

to presence of loose connective tissue and its articular surface structure [14]. In contrast, accessory sacroiliac joints are true synovial joints [4-6,14,15,18-20]. Since both are located in the same region, the axial sacroiliac joint can be confused with the accessory sacroiliac joint especially on radiographs [5,14,18]. Although ASIJ is defined as a syndesmosis by some researchers, it is more commonly described as a synovial joint [4-6,17,18].

ASIJ has a higher prevalence in older people, obese individuals and women with a history of 3 or more deliveries [13]. Looking at the literature, the reported prevalence of ASIJ varies from 1.7% to 50% across studies using CT scans and examination of dried skeletons [9,10,12,17,18,21] (Table 1).

Since most ASIJ cases are asymptomatic and often detected incidentally, clinical significance of ASIJ may be overlooked. However, there are studies reporting that ASIJ is associated with degenerative arthritis and may be a source of chronic hip or back pain [7-11,16,21-23].

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Table 1. Studies on the accessory sacroiliac joint and the prevalences reported.

Study	Materials Examined	Prevalence
Petersen (1905) (27)	skeletal specimens	16%
Derry (1911)(15)	skeletal specimens	10.4%
Jazuta (1929) (28)	skeletal specimens	27%
Kaibo (1932) (29)	skeletal specimens	10%
Trotter (1937, 1964) (4, 19)	skeletal specimens and cadavers	21–50%
Hadley (1952) (6)	skeletal specimens	18%
Ehara et al. (1988) (1)	CT images, skeletal specimens	16%–13%
Vleeming et al. (1990) (17)	CT images	18%
Valojerdy and Hogg (1990) (8)	skeletal specimens	18%
Prassopoulos et al. (1999) (3)	CT images	19.1%
Demir et al. (2007) (23)	CT images	17.5%
Fortin and Ballard (2009) (7)	CT images	3.6%
Klang et al. (2017) (20)	CT images	4.5%
El Rafei et al. (2018) (26)	MRI scans	11%
Tok Umay and Korkmaz (2020) (9)	CT images	1.7%
Teran-Garza et al. (2021) (24)	CT images	19.8%
Ziegeler et al. (2021) (25)	CT images	16.8%
Current study	CT images, skeletal specimens	6.8%–15.2%

With this study, we aimed to provide data on the prevalence of anatomical variations of the SIJ in the general population, to review and interpret CT images for the ASIJ and ultimately, to contribute to the literature.

METHODS

For this study, CT images of 145 individuals (104 males and 41 females) referred to the Radiology outpatient clinic of Gaziantep University Medical Faculty between 2013 and 2018 as well as 92 sacral bones were examined. Dry bones used in this study were obtained from the bone collections of the anatomy departments of Gaziantep and Çukurova Universities (southern Turkey). There was no information on the age and sex of the sacral bones included in the study.

CT images were acquired using a GE LightSpeed Pro 32-slice CT scanner (GE Healthcare Systems, USA) with the patient in supine position. Images were reconstructed using a bone algorithm with 7 mm thickness and 5 mm increments in axial and coronal planes. CT images allowing visualization of the SIJ were included in the study.

Statistical Analysis

Statistical analysis was not performed because a prevalence study was conducted. The frequency values of the parameters are given as numbers and percentages.

RESULTS

Examination of the dry sacral bones (n=92) revealed an ASIJ prevalence of 15.2%. The ASIJ was more commonly (52%) located at the posterior portion of the SIJ (between the posterior superior iliac spine and sacral crest), at the level of the second dorsal sacral foramen. In 48% of the bones, ASIJ was identified just above the first dorsal sacral foramen (Figure 1). Unilateral ASIJ was observed in 10.8% and bilateral ASIJ in 4.4% of the sacral bones (Figure 2) (Table 2).

On CT images of 145 individuals, the frequency of ASIJ was 7.8% (n=7) in males and 7.2% in females (n=3) (Figure 3) (Table 3). In the study population, the total prevalence of SIJ variations was 28.9% and the prevalence of ASIJ was 6.8%.

Table 2. Prevalence of the accessory sacroiliac joint by its position and location relative to sacral foramen in dry bone specimens.

	S1		S2		Total	
	n	%	n	%	n=92	15.2%
Bilateral	2	50%	2	50%	4	4.4%
Unilateral	4	40%	6	60%	9	10.8%

Main Points

- Accessory sacroiliac joint (ASIJ) may be a cause of arthritis and chronic hip pain.
- For early diagnosis of chronic hip pain, the presence of an ASIJ should be investigated by imaging studies.

Table 3. Prevalence of accessory sacroiliac joint within sacroiliac joint variations by age and gender (CT images).

	18 to 29 years	30 to 39 years	40 to 49 years	50 to 60 years	Total
	n=74	n=24	n=25	n=22	n=145
Female (n= 41)	2			1	3 (7.2%)
Male (n=104)	1	2	3	1	7 (7.8%)
Total	3	2	2	2	10 (6.8%)



Figure 1. Posterior view of the sacral bone: 1) Sacroiliac joint, 2) 1st Dorsal sacral foramen, 3) 2nd Dorsal sacral foramen, 4) Median sacral crest, 5) Accessory sacroiliac joint, 6) Axial sacroiliac joint.



Figure 2. Posterior view of the sacral bone and pelvis; yellow circled area indicates a unilateral accessory sacroiliac joint (right).



Figure 3. On the CT image, the yellow arrow shows the left side accessory sacroiliac joint.

DISCUSSION

The etiology of the variations of the sacroiliac joint and the ASIJ remains unclear. It is also unknown whether the ASIJ is a congenital or acquired joint [20,23]. This accessory joint may either be a true diarthrodial joint and present at birth or acquired as a fibrocartilaginous joint after childbirth [12]. Petersen (1905) and Jazuta (1929) found hyaline cartilage and joint capsule in some of the specimens, suggesting that ASIJ may be present at birth [20,23]. In contrast, Rixey et al. [21] did not observe ASIJ in children aged 0 to 15 years, and suggested that it is unlikely to be a congenital variant present at birth. However, they argued that the curvature of the SIJ in the expected location of the ASIJ, which increases in prevalence and severity with age, may predispose individuals to the development of an ASIJ later in life.

Unilateral or bilateral ASIJ is associated with degenerative changes such as subchondral sclerosis, osteophytes and ankylosis [7, 11, 23]. Statistically, patients with ASIJ were reported to present with a higher frequency of sclerosis and osteophytes compared to individuals with normal joint anatomy [24].

Slobodin et al. [22] reported that younger patients often have complaints of chronic or recurrent sacroiliac pain in the presence of an ASIJ with surrounding bone marrow edema and periarticular soft tissue inflammation, which correlate with the clinical picture.

Computed tomography is not the diagnostic tool of choice for younger patients with chronic hip or low back pain. However, CT aids in the detection of structural changes or anatomical variations,

and is also useful in differentiating the cause of sacroiliitis other than ankylosing spondylitis or axial spondyloarthritis. A reason for delayed diagnosis is that many clinicians are unaware of the fact that ASIJ may be a cause of chronic hip or low back pain [16, 22].

In a study by Demir et al. [23] using CT images, ASIJ was the most common variation of the sacroiliac joint (17.5%) and most of the patients with ASIJ did not have low back pain complaints. However, there are studies reporting that ASIJ is the source of chronic hip or low back pain, especially with severe arthritis and degenerative changes [9,12,21,22]. Klang et al. [20] identified abnormal sacroiliac joints in 31% of individuals less than 40 years of age with complaints of low back pain, and ASIJ was shown on CT images in 4.5% of them. In another study, an ASIJ surrounded by bone marrow edema was detected on MRI scan in a 53-year-old patient with low back pain and buttock pain [10].

As a result of our review of CT images, we found that 28.9% of the study sample had SIJ variations and among them, 6.8% had ASIJ. In a study involving healthy subjects, Ziegeler et al. [25] reported an ASIJ prevalence of 8.3%. Of the 818 joints examined in that study, this variant was present in 51 females and 17 males. In a study examining anatomical variations of the SIJ in the Hispanic population, the prevalence of ASIJ was 19.8%, with a higher frequency of SIJ variants found in females and individuals older than 40 years of age [24].

The discrepancy between our results and some of the previous reports may be related to the difference in the populations studied.

Former osteological studies have reported on the prevalence of ASIJ in relation to sex, age and race. In a comprehensive study involving 958 pelvic bones, Trotter [19] reported an increase in the prevalence of ASIJ with advancing age as well as a higher frequency in whites (50%) than in blacks (21%) [4,15,19,20].

When we examined the sex distribution of the subjects with ASIJ, 7 (7.8%) of them were male and 3 (7.2%) were female. In a study by Fortin et al. [7], ASIJ was identified in 20 individuals, of whom 5 were males and 15 were females. Contrastingly, Valojerdy and Hogg [8] reported that sex does not have an impact on the prevalence of ASIJ.

In a study of the anatomical variations of the SIJ on MRI images, the prevalence of ASIJ was 11%. While 53% of these variations were bilateral, 45% were at the level of the first dorsal sacral foramen and 55% at the second dorsal sacral foramen. In the same study, it was reported that the occurrence of ASIJ did not differ between sexes [26]. When we examined the prevalence of ASIJ in relation to its location, 9.8% of the cases were unilateral and 4.4% were bilateral. Thus, our current results are consistent with the aforementioned findings.

If the anatomical variations of the SIJ are correlated with dematous or structural changes, they can be easily misdiagnosed on MRI scans. ASIJ is common in the general population and may be

associated with the coexistence of back and sacroiliac joint pain. Therefore, rheumatologists, physical therapists, orthopedists and algologists should be familiar with this anatomical variation and be able to differentiate imaging features of other diseases (e.g., axial spondyloarthropathy) that mimic sacroiliitis mimicking [1,10-13,16,18].

Limitations

A number of limitations should be noted for this study. Firstly, this was a single-center study with a sample size. Since the study had a retrospective design, it was not possible to obtain any information on the complaints of the population studied. It would have been useful to classify the subjects as those with or without hip pain. Further multicenter studies involving greater numbers of CT images and dry bones are needed to corroborate our findings.

CONCLUSION

ASIJ can be a cause of arthritis or chronic hip pain. The differential diagnosis of hip pain should include ASIJ, which can be identified through additional imaging studies and allows for early diagnosis.

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