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General Consideration

Sacroiliac joint (SIJ) pain is one of the differential diagnoses of low back pain. Approximately 90% of the population will present to a health service with low back pain during their lifetime, and 10–25% of these patients will have SIJ pain. It is more common after the fifth decade of life, especially in obese and sedentary patients. Risk factors for SIJ pain include but not limited to sacroiliac dysfunction, pregnancy, older age, pelvic alignment pathologies, degeneration, joint

mobility pathologies, core muscle weakness, inflammation, and trauma.

There are various primary causes of SIJ pain, the most common of which is degenerative arthritis that is characterized by joint space narrowing, osteophyte formation, and joint sclerosis. It is also caused by abnormal motion (hypermobile) or malalignment of the joint. In patients manifesting other symptoms, a diagnosis of inflammatory arthropathy (sacroiliitis) should be considered. This includes the spondyloarthropathies—notably ankylosing spondylitis, reactive arthritis, and psoriatic arthritis. Other major causes are trauma (that results in ligament strain and fractures) and infections. Secondary conditions that may generate SIJ pain are spinal fusion procedures, scoliosis, or leg length discrepancy. Lumbar spine arthrodesis can also be responsible for SIJ pain since it increases impact load on the SIJ, causing mechanical overload and subsequently sacroiliitis.

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Indication (Patient Selection)

Many attempts have been made to improve accuracy in diagnosing SIJ pain, mainly through physical examination, imaging techniques, and local anesthetic blocks. An incorrect diagnosis may lead to treatment failure and waste of health-care resources.

Patients will complain of pain upon prolonged sitting or standing, on climbing stairs, or while lying down on the painful side. Pain is usually localized to the buttock region, but multiple pain referral patterns may occur, including from the posterior thigh and knee, radiating into the foot and mimicking radicular pain. The literature shows that the prevalence of pain among cases was 94% in the ipsilateral buttock region and 74% in the lower lumbar area, of which up to 50% have radiation to the lower extremity—6% to the upper lumbar area, 4% to the groin, and 2% to the lower abdomen. The pain is described as sharp, stabbing, or shooting. The patient often points to the area between the gluteal folds and posterior iliac crests.

There are several specific physical tests to improve accuracy in diagnosing SIJ pain; however, none are considered the gold standard. Patrick's test (or FABER) is done with the patient lying supine. The hip and knee are flexed to 90°, and the thigh is abducted and then externally rotated. If pain is elicited over contralateral SIJ, the test is considered positive. Though not specific for SIJ pain, provocation tests (Gaenslen's, distraction, thigh thrust, and others) may prove useful. Three or more positive provocation tests have a sensitivity of 91% and a specificity of 78% for SIJ pathology. The physical examination can reveal pelvic asymmetry, confirmed by the measurement of the limbs, and the spinal examination can identify abnormal curvatures or movement abnormalities. Despite citing referred pain, the patient generally has normal spinal range of motion, normal neurological exam, and negative straight leg raising test.

Diagnosing SIJ pain is quite challenging since low back pain and pain around the hips and the gluteal region may be attributed to other causes. Imaging studies are recommended to exclude alternative sources of pain such as malignancy, infection, and fracture. The main diagnostic tool is the SIJ injection, which is also therapeutic because of its target specificity. These injections can be done using fluoroscopy, ultrasound, or CT guidance.

In the literature, landmark-guided injections are not recommended because the incidence of real intra-articular injection is only 22%, while those of epidural or sacral foraminal injection are 24% and 44%, respectively. The low rate of intra-articular injection using landmark-guided techniques warrants the use of image guidance. Ultrasound guidance is more readily available and feasible in clinical practice. Reportedly, its success rate was 60% in the first 30 injections, gradually improving to attain 93% in the last 30 injections.

Although there are no reference standards to confirm diagnosis, greater than 50–75% post-injection pain relief has been recommended.

Diagnostic blocks must be target-specific in order to improve diagnostic accuracy because SIJ innervation is complex and variable. Hence, it is sometimes challenging to perform the blocks. Additionally, if the injection is periarticular, it can miss the innervation, prompting inaccurate interpretation of injection, leading to unreliable predictive values concerning response to further treatment.

Functional Anatomy

The sacroiliac joint is a true diarthrodial joint that lies between the ilium and the sacrum within the S1-S3 topography in an oblique coronal orientation (Fig. 49.1). The surface of the SIJ measures 1.5 cm² at birth, 7.0 cm² at puberty, and it attains 17.5 cm² in adulthood. It is a synovial joint lined by hyaline cartilages and covered with dense fibrous connections. Only the anterior portion is considered a true synovial joint because the posterior connection is a syndesmosis consisting of the interosseous ligament (Fig. 49.2). The SIJ is broader cephalad and narrower in its inferior one-third. Stabilized by muscles (gluteus and paraspinal muscles) and ligaments, its main function is to transfer weight from the upper body to the lower limbs. This joint has a limited range of motion, allowing for only minimal rotation and gliding. The upper two-thirds of the joint becomes fibrotic in adulthood.

The posterior innervation stems from the S1-S3 dorsal rami via lateral branches and from the L4-L5 rami, respec-

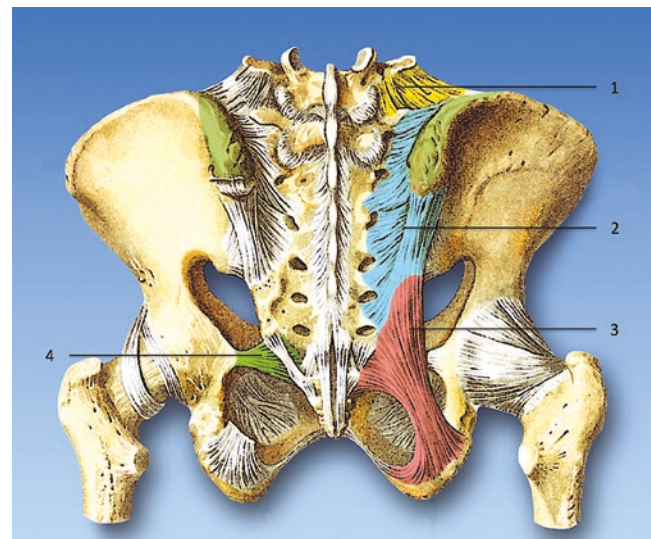


Fig. 49.1 Anatomy. (1) Iliolumbar ligament, (2) dorsal sacroiliac ligament, (3) sacrotuberous ligament, (4) sacrospinous ligament. (Reproduced with permission from Dr. Danilo Jankovicp)

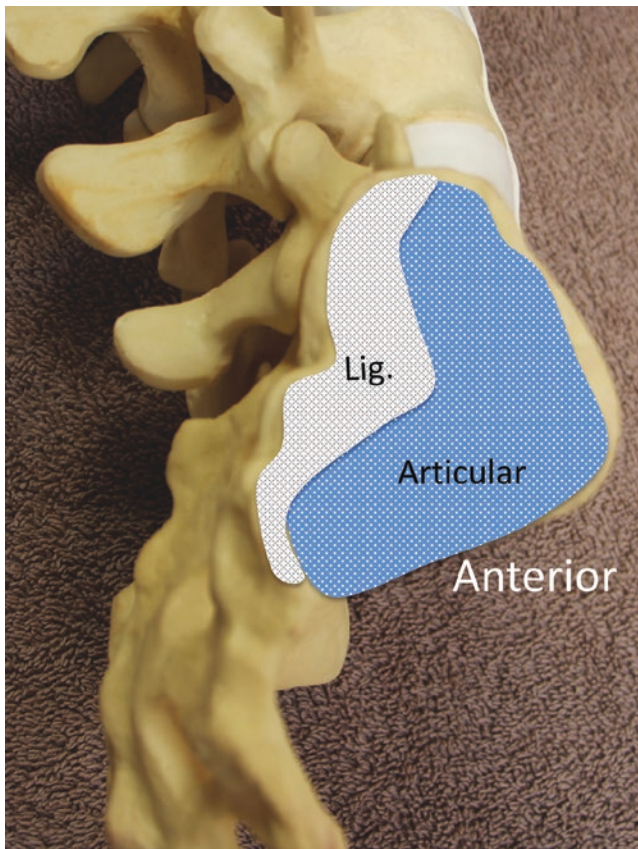


Fig. 49.2 Lateral view of the sacroiliac joint with the synovial surface (blue) and the ligamentous (lig) area. In the ligamentous area, the joint surfaces are connected with an intricate set of ligamentous connection. (Reproduced with permission of Philip Peng Educational Series)

tively, via medial and dorsal branches. The anterior innervation is provided by the lumbosacral plexus through the lateral branches of the anterior primary rami traveling from L2-S2. Contributions from the superior gluteal nerve as well as the obturator nerve have also been reported in the literature.

The anterior sacroiliac ligament is a thickening of the anterior joint capsule which connects the anterior surfaces of the sacrum and the ilium. The joint capsule is absent posteriorly, and the interosseous ligament forms the posterior border of the joint space. Accessory ligaments are comprised of the iliolumbar, sacrotuberous, and sacrospinous ligaments (Fig. 49.1). This ligament complex immobilizes the sacrum, thereby preventing *x*-axis rotation of the latter when it is subjected to gravitational forces.

Techniques

Fluoroscopy-Guided Technique

There are different techniques to access the SIJ using fluoroscopy. One of these involves placing the patient in prone

position with the C-arm positioned posteroanteriorly, oriented toward the lumbosacral region. In this view, the SIJ is seen in addition to its posterior and anterior joint lines. The posterior joint line is usually the medial one (Fig. 49.3a, b). The C-arm should be adjusted to contralateral oblique view (approximately 5°–20°) in order to superimpose anterior and posterior joint lines (Fig. 49.3c, d). Under image intensifier control, a 25- or 22-gauge spinal needle is directed into the inferior one-third of the joint using a posterior approach (Fig. 49.4). Once the needle has entered the joint, intra-articular placement is confirmed by contrast medium injection (Figs. 49.5 and 49.6). In the posteroanterior view, the contrast medium travels rostrally along the joint line, whereas in the lateral view, it outlines the joint, confirming needle position.

Another technique is to perform a tunnel view injection with the C-arm in true posteroanterior view. The target is the medial line of the inferior one-third of the joint.

Total injected volume should be limited to 1.5–3 mL of solution.

Ultrasound-Guided Technique

The patient is placed in prone position, and the posterior superior iliac spine (PSIS) is palpated. The low-frequency curved transducer is placed over the PSIS in the axial plane and then slowly advanced, scanning caudad. The SIJ can be observed when the step-off between the sacrum and ilium is less pronounced. The upper SIJ appears as an iliac prominence, and then the dorsal sacroiliac ligament comes into view (Fig. 49.7). Moving the probe caudad, the S1 and S2 neural foramina can be identified medially to the SIJ cleft. The lower third of the SIJ becomes evident from the flat contour of the iliac crest and the presence of the S2 foramen that is located 2–3 cm above the caudal pole of SIJ (Fig. 49.8). Color Doppler scan is used to distinguish vascular structures. The target is the cleft between the lateral border of the sacrum and the medial border of the ilium, representative of the posterior aspect of the SIJ. If an in-plane technique is chosen, medial to lateral needle insertion is recommended after the probe is tilted medially to allow an optimal trajectory of the needle (Figs. 49.9 and 49.10).

Complications

Blockade of the sacral plexus may occur due to aggressive advancement of needle or ventral capsular defect, dorsal leakage from the joint capsule (potentially anesthetizing posterior structures), communication between the joint and the S1 foramen, and difficult access to joint in as many as 10% of patients.

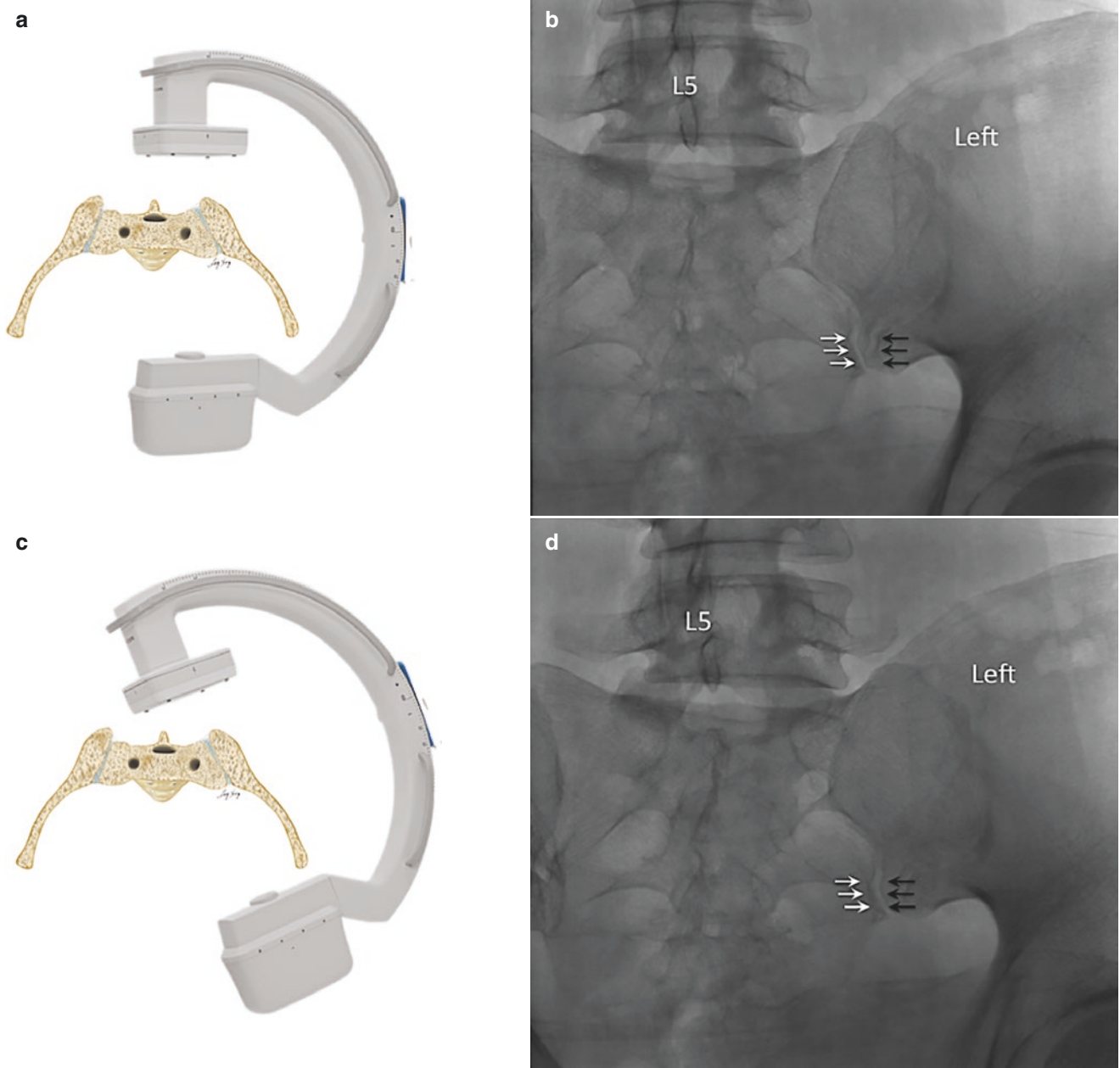


Fig. 49.3 Straight posteroanterior X-ray of the sacroiliac joint. (a) Position of C-arm with respect to the sacrum. (b) Corresponding fluoroscopic image. In this view, both anterior (black arrows) and posterior joint (white arrows) lines are seen. The posterior joint line (white arrows) is usually the more medial one. Contralateral oblique X-ray of

the sacroiliac joint. (c) Position of C-arm with respect to the sacrum. (d) Corresponding fluoroscopic image. The anterior and posterior joint lines aligned to form a crisp silhouette of the joint. (Reproduced with permission of Philip Peng Educational Series)

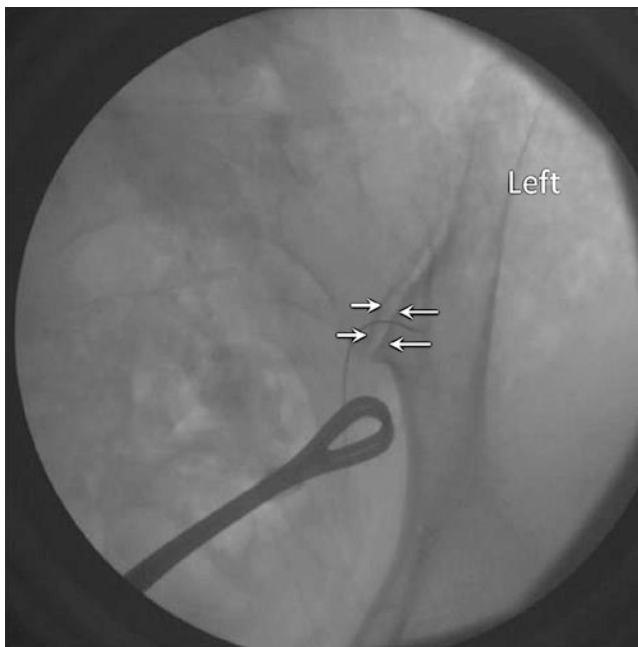


Fig. 49.4 Insertion of needle into the sacroiliac joint (SIJ). The needle is slightly bended by a swap forceps, the site of angulation was at the entrance of SIJ, and the needle inside the SIJ was only a few millimeters in length. (Reproduced with permission of Philip Peng Educational Series)

Practical Tips

1. The diagnostic blocks should always be performed under image guidance. This minimizes the probability of an extra-articular injection.
2. The total injected volume should not exceed 1.5–3 mL. This prevents extra-articular injection and false-positive results.
3. Contrast medium should be injected under fluoroscopic guidance when performing arthrograms to confirm intra-articular needle position.
4. Sacral lateral branch injection is more accurate when patients likely to respond better to radiofrequency are selected, since this technique selects only the posterior innervation. This is described in detail in the next chapter.

Literature Review

Intra-articular (IA) steroid injections have beneficial effects in 79–93% of the patients with average duration of effects lasting 9.9 months, according to various observational stud-

ies in the literature. However, owing to a lack of controlled randomized trials, the evidence is limited.

Murakami et al. observed in a prospective comparative study that improvement in pain was significantly higher in patients who had received periarticular (PA) injections after failed response to IA injections than in patients who had received IA injections alone. However, Nacey et al. concluded that there is no significant difference between IA and PA injections in the pain relief provided. There are studies in the literature comparing the effects of IA and PA injections, of which two double-blind studies showed the effectiveness of PA infiltrations in short-term pain relief. PA infiltration can be used if IA injection proves to be difficult. There is limited (or poor) evidence for PA injections of local anesthetic and steroid.

The level of evidence for conventional radiofrequency (RF) is limited, mostly due to limitations in needle positioning owing to the heterogeneous innervation of SIJ. RF ablation has shown limited efficacy due to its inability to denervate anterior neural structures and to provide long-lasting pain relief on denervation of posterior structures because these nerves regenerate within a few months.

In the setting of a negative IA anesthetic injection via sacral lateral branch block, the posterior ligaments may be considered potential pain generators. Recently, a randomized controlled trial compared ultrasound- and fluoroscopy-guided sacral lateral branch blocks in 40 patients and concluded that pain relief was similar in both the groups 30 days after the procedure. However, the study did reveal that the ultrasound technique had some advantages such as shorter times and fewer needle punctures, lower radiation exposure, and a lower risk of vascular breach. Another study compared the same two methods and also found no significant difference in pain scores after 1 and 3 months as well as similar functional outcomes.

A 2015 systematic review with a meta-analysis of the effectiveness of RF ablation for the treatment of SIJ pain concluded that RF is an effective treatment at 3 and 6 months, but its conclusions are limited by little available literature and a lack of randomized controlled trials. Diagnostic accuracy is Level 2 for dual diagnostic blocks with at least 70% pain relief as the criterion standard and Level 3 for single diagnostic blocks with at least 75% pain relief as the criterion standard. The evidence for cooled radiofrequency is Level 2–3; however, it is limited for conventional RF, IA steroid injections, and PA injections with steroids or botulinum toxin, which are rated as Level 3–4.

A prior systematic review of the therapeutic effectiveness of all SIJ interventions (IA injections, PA injections, conven-

Fig. 49.5 Fluoroscopic image showed the contrast traveling in the rostral direction (white arrow heads). Right image is the zoomed image of the left. (Reproduced with permission of Philip Peng Educational Series)

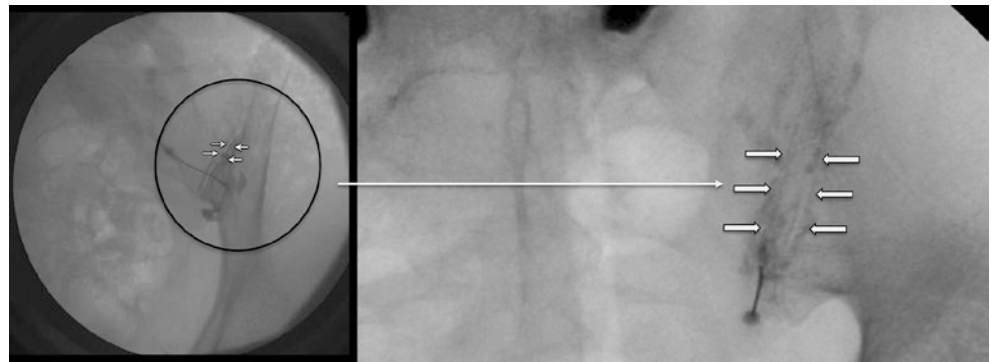


Fig. 49.6 Lateral view of the sacroiliac joint. The needle was marked by black arrows. The lower perimeter of the joint space was marked by the white arrows. (Reproduced with permission of Philip Peng Educational Series)

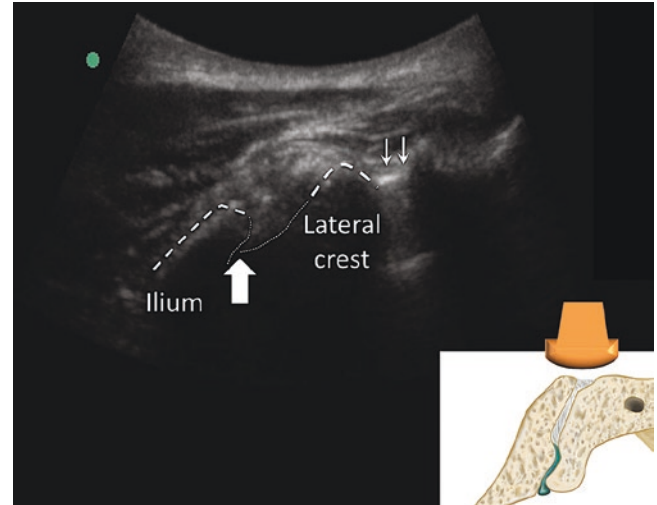


Fig. 49.8 Sonography of the lower sacroiliac joint (SIJ). The probe position was indicated in the insert in the lower right corner. The SIJ was indicated by the bold arrow, which is typically lateral to the lateral crest. Note the flat appearance of the ilium. The S2 foramen was indicated by the line arrows. The bold dotted line outlines the hyperechoic shadow of the bone while the faint dotted line outlines the bone contour that is not seen. (Reproduced with permission of Philip Peng Educational Series)

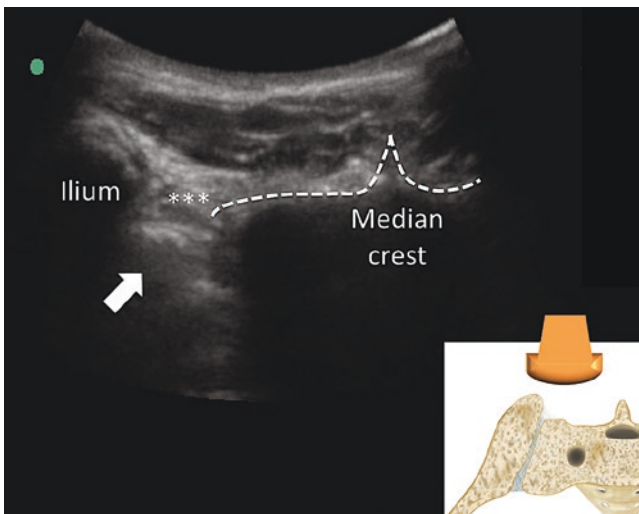


Fig. 49.7 Sonography of the upper sacroiliac joint (SIJ). The probe position was indicated in the insert in the lower right corner. The SIJ was indicated by the bold arrow. Note the prominence of the ilium. The median crest is outlined by the dotted line. ***—dorsal sacroiliac ligament. (Reproduced with permission of Philip Peng Educational Series)

tional RF, cooled RF) had found the greatest amount of supporting evidence for cooled RF lateral branch blocks based on two randomized controlled trials and two observational studies. Other interventions have weaker proof of their effects.

In light of the complexity of the SIJ joint, multifactorial causes may lead to SIJ dysfunction, making it a challenge to diagnose. Accordingly, diagnostic workup should include physical examination, laboratory and radiological tests, and diagnostic blocks. The latter are considered the gold standard though some controversy still surrounds their application (use of single or dual injections) and selection (choice of intra-articular or peri-articular injections, or intra-articular or lateral sacral branch injections). Treatment involves various interventions and rehabilitation therapies; but the evidence is limited for most of them, mainly because higher-quality studies are still needed.

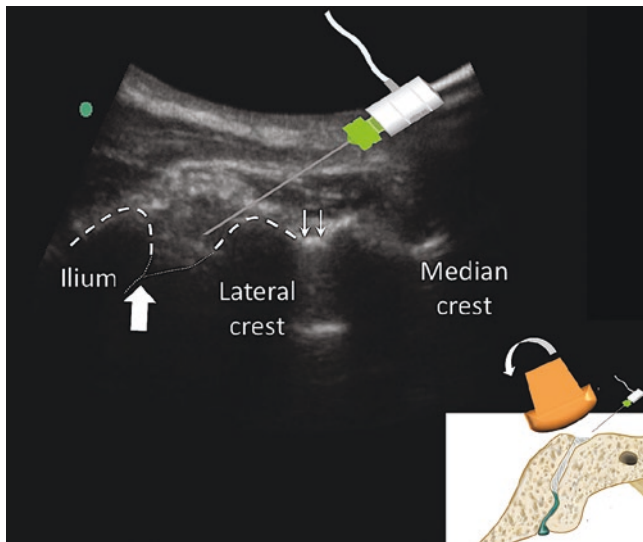


Fig. 49.9 Sonography of the lower sacroiliac joint (SIJ) similar to Fig. 49.8, but the ultrasound probe was tilted toward the midline to allow a steeper angle of the needle. The probe position was indicated in the insert in the lower right corner. The SIJ was indicated by the bold arrow and the needle trajectory is shown with a simulated needle. (Reproduced with permission of Philip Peng Educational Series)

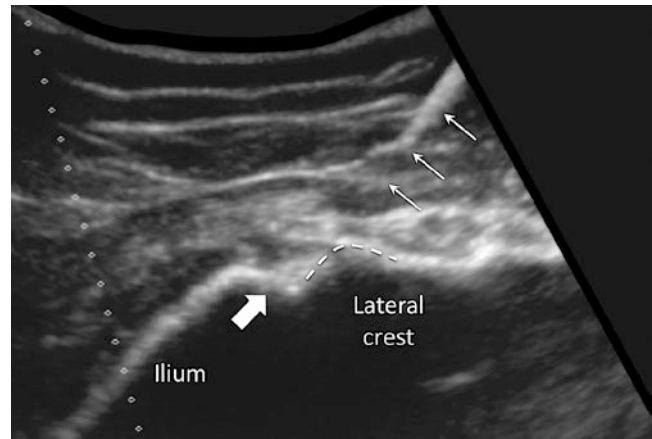


Fig. 49.10 Sonography of the lower sacroiliac joint (SIJ) with the needle (line arrows) inserting in-plane in a medial to lateral direction. The SIJ was indicated by the bold arrow. (Reproduced with permission of Philip Peng Educational Series)

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