Chapter 46

Lumbar Facet Joint and Nerve Injection

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Persistent low back pain is common globally. Epidemiological surveys in the United States reported a prevalence rate of 19 % for chronic low back pain during a 12-month period. Other industrialized nations reported similar findings, with prevalence rates ranging 13–28 %. Over 13 million Americans are permanently disabled by back pain, which results in a significant economic burden to the society [1]. However, it is often difficult to reach a definitive diagnosis and provide appropriate treatment. Potential sources of low back pain include intervertebral discs, nerve roots, facet joints, and sacroiliac joints [2, 3]. The lumbar facet joint was first considered as a source for low back pain in 1911 by Goldthwaite. Based on systematic reviews and diagnostic accuracy studies, the prevalence of lumbar facet pain ranges between 25 and 45 % [4]. Facet joint pain may be managed by facet joint nerves block, intra-articular injections, and radiofrequency denervation of facet joint nerves. In the chapter, only the injection techniques will be discussed.

Anatomy

The facet joint of the lumbar spine is a diarthrodial or synovial joint containing the hyaline cartilaginous surface, synovial membrane, and a fibrous capsule. The joint space is small, with a volume of about 1 and 1.5 mL. Each facet joint is innervated by the medial branches of the dorsal rami from the same vertebral level and from the vertebral level above [5, 6]. For example, L4–5 facet joint receives dual innervations from L3 and L4 medial branches, which are typically blocked on the transverse processes of L4 and L5, respectively. The medial branches of the L1–L4 dorsal rami have a similar course (Fig. 46.1). Each medial branch crosses in a groove formed by the junction of the transverse process and SAP of the vertebral level below (e.g., L3 crosses the transverse process of L4). Here, it runs beneath the mamilloaccessory ligament before it innervates the multifidus muscle, interspinous ligament, and the periosteum of the neural arch. The L5 dorsal ramus differs from the other lumbar dorsal rami in that it itself runs along the junction of the sacral ala and superior articular process of the sacrum and gives off the medial branch only as it reaches the caudal aspect of the L5–S1 zygapophyseal joint. Histologic studies supported the lumbar facet joints as a source of pain generator as they are richly innervated with encapsulated (Ruffini-type endings, pacinian corpuscles), unencapsulated, and free nerve endings [5, 6].

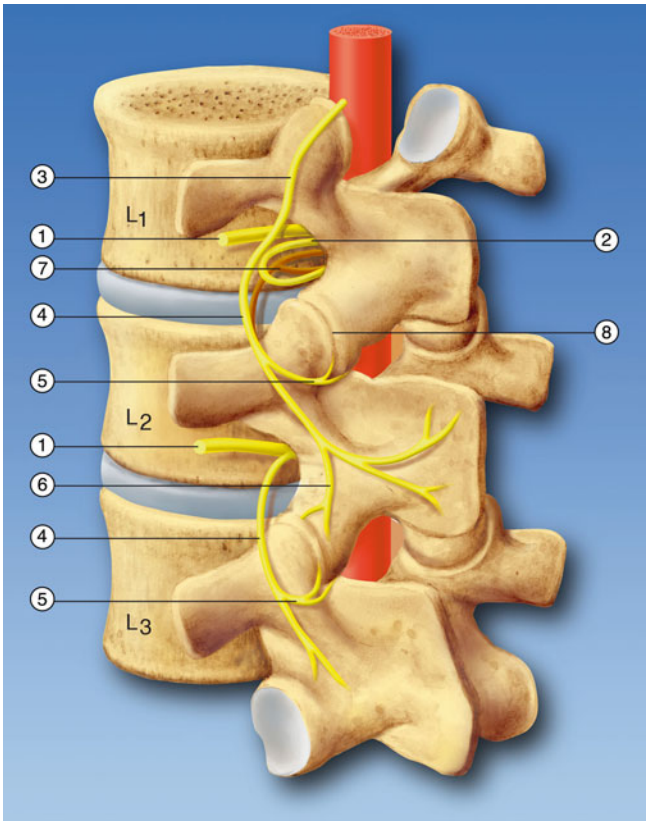

Fig. 46.1 Dual neural supply of the facet joint. Oblique parasagittal view of overlapping segmental innervation of the facet joint. (*1*) Ventral branch of spinal nerve, (*2*) dorsal branch of spinal nerve, (*3*) ascendant branch of dorsal ramus, (*4*) medial branch of dorsal ramus, (*5*) distal branch of medial ramus to facet joint, (*6*) proximal branch of medial ramus to facet joint, (*7*) posterior ramus (sinuvertebral nerve of Luschka), (*8*) facet joint (Reproduced with permission of Danilo Jankovic)

Technique

The popular technique for both facet nerve and joint block is by fluoroscopic guidance, but ultrasound-guided techniques have been described and validated [7–10].

Fluoroscopic Guided Facet Nerve Block

The patient is placed in prone position with a pillow supporting the pelvis for comfort and to obliterate the lumbar lordosis. The techniques for the blockade of L1–L4 medial branches are the same [11]. The first step is to count the appropriate level. Once the level is counted, the target vertebral level is squared, that is, the anterior and posterior silhouettes of the lower border of vertebra are at the same level. The C-arm is then rotated ipsilaterally to the side of injection to obtain an oblique view. In this view, the outline of the "scotty dog" is clearly evident (Fig. 46.2). The target is the junction of the superior border of transverse process with the superior articular process. Alternatively, another end point has been described, which is the midpoint between the mamilloaccessory notch and the target point just described in Fig. 46.1 (Fig. 46.3). This target point has been shown to minimize the inadvertent spread of injectate into the intervertebral foramen or epidural space. For the L5 dorsal rami block, the target point is the ala of the sacrum at the base of the superior articular process of sacrum in an anteroposterior view (Fig. 46.4).

A 22-gauge spinal needle is inserted following local anesthetic infiltration of the skin. Once the bone is contacted at the target point, a small amount of contrast (0.2 mL) is injected to detect possible venous uptake. If there is no venous uptake, 0.5 mL of local anesthetic is injected.

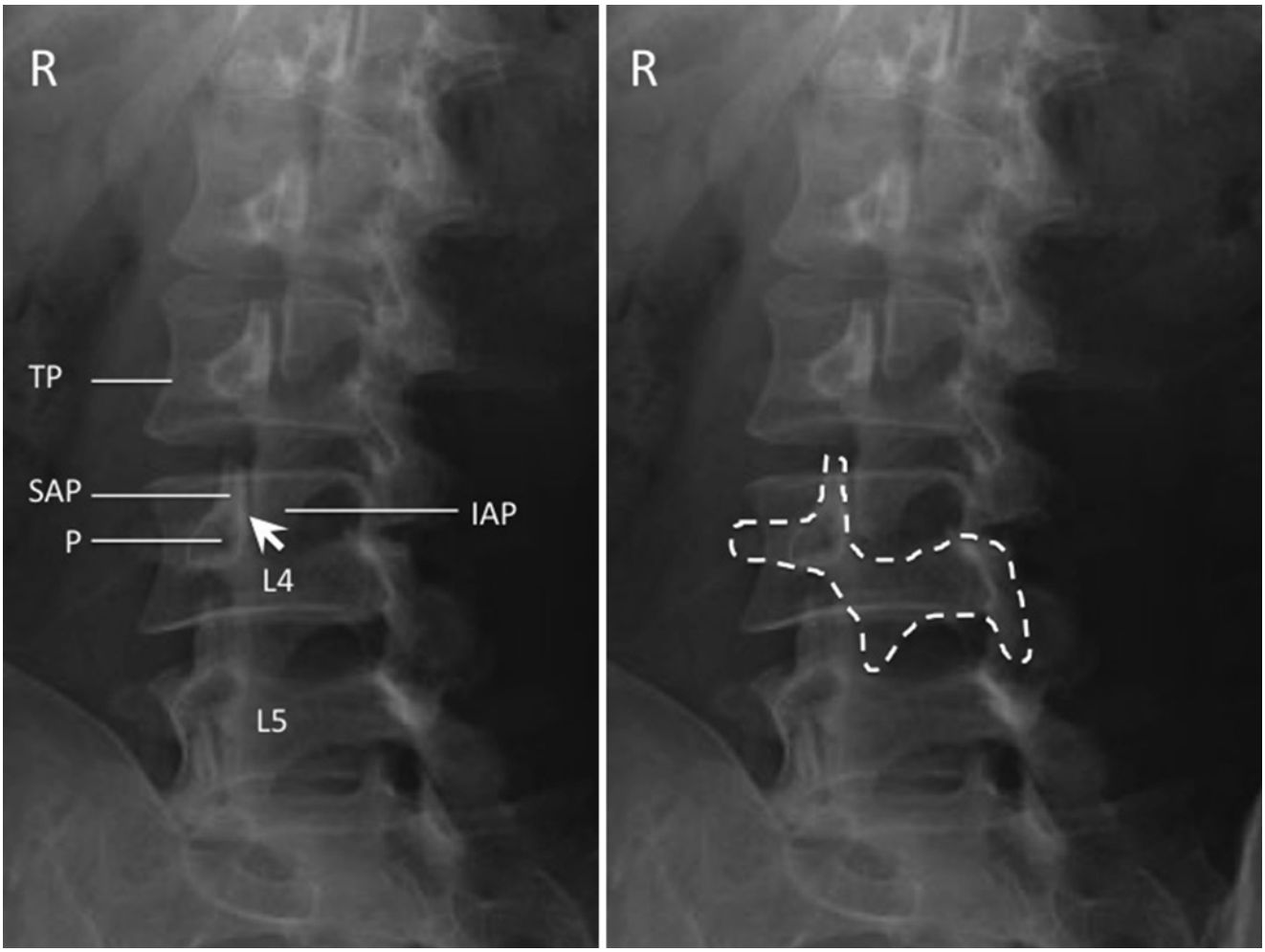

Fig. 46.2 Oblique radiograph of the lumbar spine. The *left figure* shows the individual structures: *SAP* superior articular process, *IAP* inferior articular process, *P* pedicle, *TP* transverse process; facet joint is indicated by the *arrow*. The *right figure* shows the "scotty dog" appearance of the same structure (Reproduced with permission from Philip Peng Educational Series)

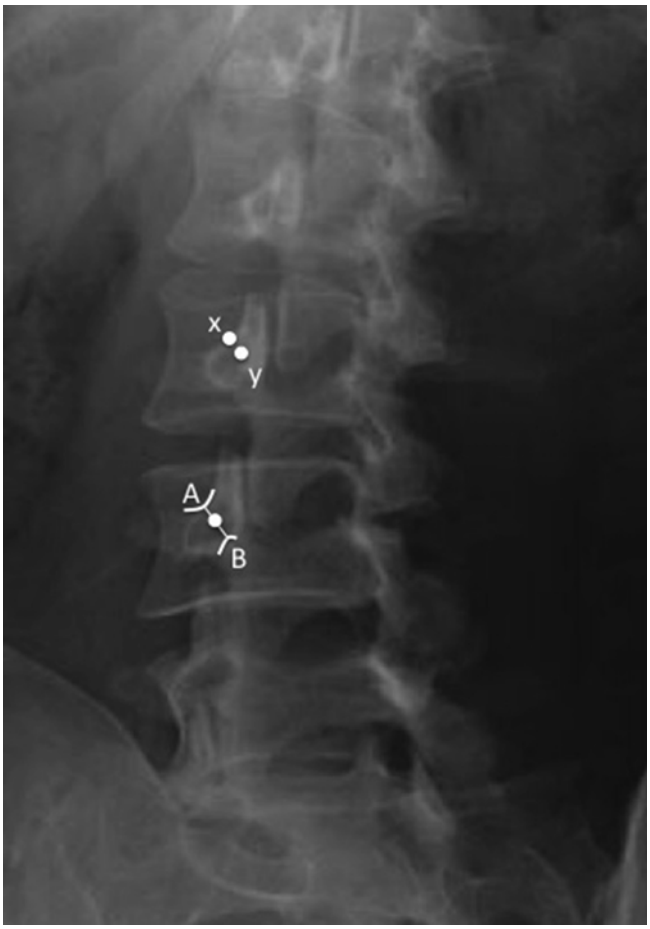

Fig. 46.3 The radiograph shows the target points (*white dots*) for facet medial branch injection. *A* The junction of the superior border of transverse process with the superior articular process. *B* The mamilloaccessory notch. *x* The conventional target which is the junction of the superior border of transverse process with the superior articular process. *Y* The midpoint between A and B (Reproduced with permission from Philip Peng Educational Series)

Fig. 46.4 The target points for L5 dorsal rami was indicated by the white dots, which are the ala of the sacrum at the base of the superior articular process of sacrum (Reproduced with permission from Philip Peng Educational Series)

Fluoroscopic Guided Facet Joint Injection

The patient is positioned as for the facet medial branch block. Oblique view is obtained until the joint space formed between the articular processes is optimally seen (Fig. 46.2). A 22-gauge spinal needle is inserted with coaxial technique. A small amount of contrast (0.2 mL) is injected to confirm the intra-articular placement. A volume of 0.5–1 mL injectate (20 mg methylprednisolone or triamcinolone) is sufficient. In patient with advanced disease, the joint space may be further obliterated. In that case, periarticular injection may be performed.

Ultrasound-Guided Facet Medial Branch Injection

The position of the patient is the same as the fluoroscopic guided technique. The target point is the junction between the superior articular process and transverse process. A curvilinear ultrasound probe (2–5MHz) is used to obtain a parasagittal oblique view. In this scan, both the sacrum and lamina can be seen and used for counting (Fig. 46.5). The probe is then moved laterally to visualize the transverse process (Fig. 46.6). Once an appropriate level is identified, the probe is rotated 90° to obtain a short axis view of the spine showing the transverse process and the corresponding superior articular process. The probe is then moved in cephalad direction until the cephalad aspect of the transverse process disappears. When this part of the transverse process reappears on sliding back the probe in caudal direction, the target is defined (Fig. 46.7). A 22-gauge spinal needle is inserted in-plane from lateral to medial to hit the bony target. Once this is achieved, the probe is turned 90° to demonstrate the needle is at the cephalic part of the transverse process (Fig. 46.8). The L5 dorsal ramus is usually difficult to assess because of the ilium.

Ultrasound-Guided Facet Joint Block

The initial scanning technique is similar to that of facet medial branch. Once the short axis scan of the spine shows the transverse process and the superior articular process, the final position of the probe is tilted in cephalad and caudal direction until a joint space opening is clearly seen between the superior and inferior articular process (Fig. 46.9). A 22-gauge spinal needle is inserted in-plane from lateral to medial to hit the bony target. In patient with limited joint space, advancing the needle into the joint space can be difficult, and a periarticular injection is reasonable.

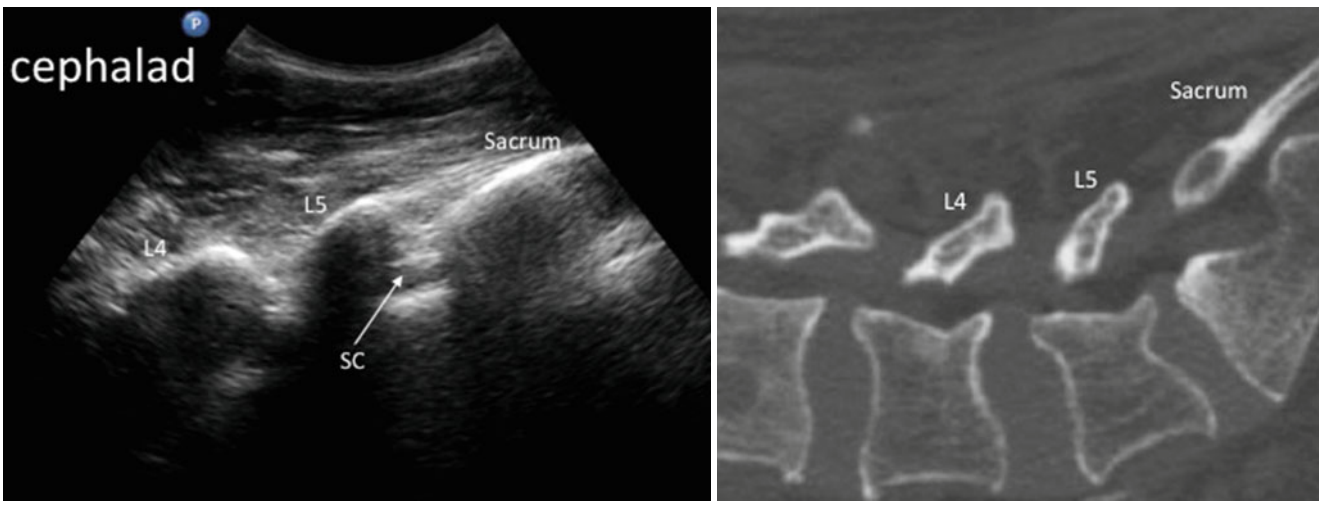

Fig. 46.5 Parasagittal oblique ultrasound view of the spine at the lumbosacral junction on the left and the corresponding magnetic resonance image on the right. *SC* spinal canal (Reproduced with permission from Philip Peng Educational Series)

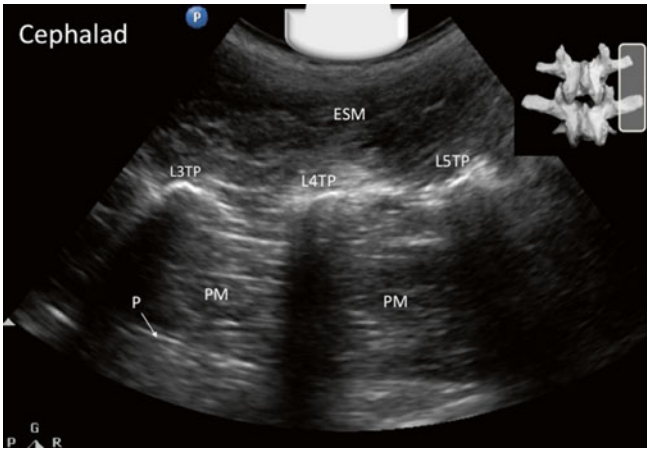

Fig. 46.6 Parasagittal ultrasound scan of the transverse process. The *insert* showed the position of the ultrasound probe. *ESM* erector spinae muscle, *PM* psoas muscle, *L3TP* transverse process of L3 (Reproduced with permission from Philip Peng Educational Series)

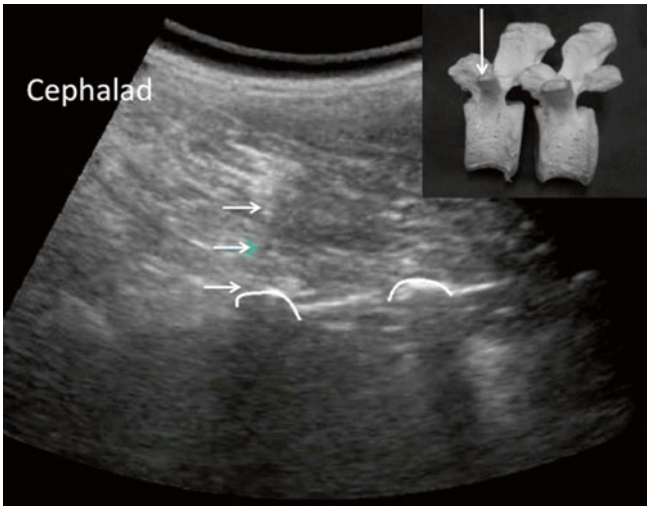

Fig. 46.8 Parasagittal of the transverse process showed the needle (indicated by the *arrows*), which was out-of-plane to this diagram. The transverse process was indicated by the line, and the *insert* showed the position of the needle (Reproduced with permission from Philip Peng Educational Series)

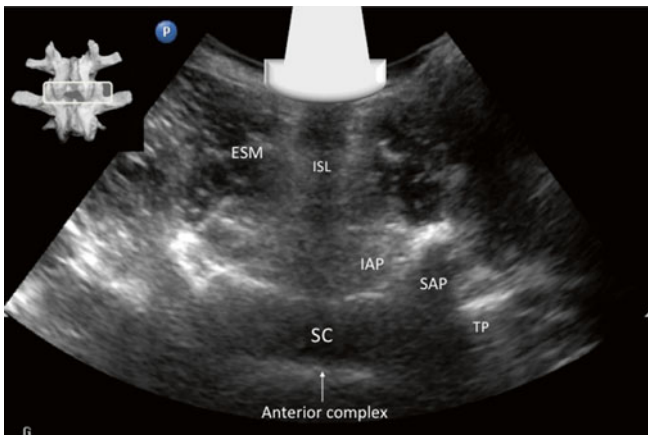

Fig. 46.7 Transverse scan of the spine at the interlaminar space. The insert showed position of the ultrasound probe. *ISL* interspinous ligament, *ESM* erector spinae muscle, *SAP* superior articular process, *IAP* inferior articular process, *TP* transverse process, *SC* spinal canal (Reproduced with permission from Philip Peng Educational Series)

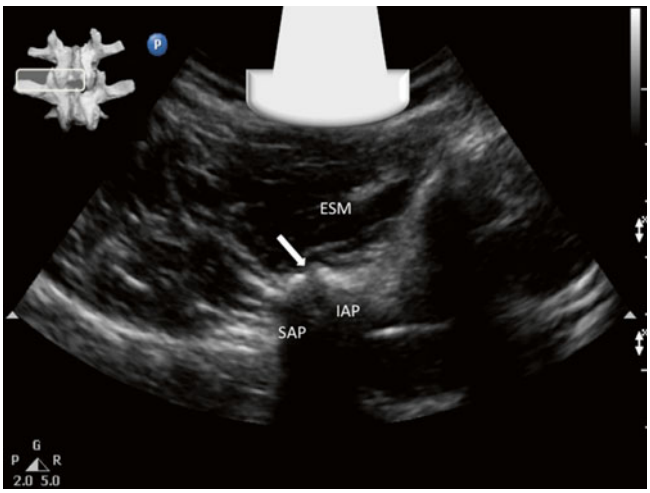

Fig. 46.9 Sonograph showed the facet joint indicated by the *bold arrow*. *ESM* erector spinae muscle, *SAP* superior articular process, *IAP* inferior articular process. The *insert* showed the position of the probe (Reproduced with permission from Philip Peng Educational Series)

Use of Facet Block in Clinical Practice

Both fluoroscopy and computer tomography (CT) scan are the gold standard for the guidance of facet nerve or joint block. Although the application of ultrasound has been validated both in clinical and preclinical setting, the accuracy is only approximately 90 %. In addition, those validated studies were performed on low body mass index (BMI) patient [8–10]. The accuracy dropped to 60 % when the BMI is above 30 [12]. In addition, the utility of this in L5 dorsal rami is not well described. The author reserves the use of ultrasound-guided facet block as an alternative to patients with low BMI only.

In clinical practice, it is generally accepted that diagnostic facet blocks are the most reliable means for diagnosing facet joints as pain generators, as historic, physical, and radiologic examination findings can reliably predict response to diagnostic facet nerve or joint blocks [4, 5]. Facet nerve and joint blocks are often described as "equivalent," as neither of these approaches have been shown to be superior [13]. In addition, both medial branch and intra-articular blocks are associated with significant false-positive and false-negative rates [13]. A positive response refers to 50 % or greater pain reduction lasting for the duration of action of the local anesthetic (e.g., >30 min with lidocaine and 3 h with bupivacaine). Using a pain relief cutoff over 50 % did not result in any significant improvement in RF outcomes [14]. Double, comparative blocks are associated with a significant false-negative rate and have not been shown to be cost-effective [13]. Thus, a single block is usually adopted for the diagnosis of facet joint pain.

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