Piriformis syndrome is a condition that is often overlooked, and that should be considered when assessing chronic pelvic pain. Patients usually describe deeply localised pain in the gluteal region where the piriformis muscle is located. Patients with piriformis syndrome have long-term chronic pelvic pain. The diagnosis and treatment process of such patients is challenging. It can be diagnosed with an accurate examination and anamnesis, and can be treated using various methods.

Pathophysiology

Primary causes are associated with anatomical variations (split piriformis muscle, split sciatic nerve and anatomical variations of the sciatic nerve), and these can be seen at a rate of 15%. Secondary causes (85%) mostly include macrotraumas and microtraumas to this region and masses, leading to ischaemia. Macrotraumas to this region may cause sciatic nerve compression after soft tissue inflammation and muscle spasm. Conversely, hip pain and sciatica can cause inflammation and spasm of the piriformis muscle. Inflammatory substances secreted from inflamed muscles such as prostaglandin, histamine, bradykinin and serotonin irritate the sciatic nerve and initiate the pain-spasm-pain cycle. Inflammation, spasm or tension in the muscle may cause compression of the sciatic nerve between the piriformis muscle and the pelvis, or between the tendinous region of the piriformis muscle and the bone pelvis. In cases where the piriformis muscle lies anterior to the sciatic nerve, compression occurs between the upper border of the piriformis muscle and the upper border of the gemelli muscles. It leaves the pelvis through the greater sciatic foramen. The ilium is anterior and superior to the piriformis muscle, the sacrotuberous ligament is posterior, and the sacrospinosus ligament is inferior. If the piriformis muscle is larger than normal, this can lead to compression of the blood vessels and nerves of the pelvis. It is innervated with the S1 and S2 sacral nerves and the L5 spinal nerve in general. There are six possible different anatomical relationships between the sciatic nerve and the piriformis muscle where in the (i) sciatic nerve may pass above the piriformis muscle and (78.98%, of the population); (ii) sciatic nerve divisions may pass through and above the piriformis muscle (12.21%); (iii) sciatic nerve divisions may pass through and above the piriformis muscle; (iv) sciatic nerve divisions may pass above and below the piriformis muscle; (v) sciatic nerve may pass through the piriformis muscle; and (vi) sciatic nerve may pass above the piriformis muscle.

The piriformis muscle acts as an external rotator, weak abductor and weak flexor of the hip, providing postural stability during ambulation and standing. In weight-bearing activities, the piriformis muscle restrains vigorous or excessive medial rotation of the thigh.
the greater sciatic foramen. In such patients, signs of neurological deficits and positive electrophysiological results can be observed. The sciatic nerve is shortened because scar tissue that develops after laminectomy compresses nerve fibres. Thus, the piriformis muscle becomes prone to repetitive tension and trauma. Microtraumas can develop owing to muscle overuse conditions, such as long-distance walking, running, cycling and rowing. Microtrauma findings can also be seen with repetitive long-standing low pressure (long sitting on hard surfaces, and wallet pressure). Weak hip abductors (the gluteus medius) and tight adductor muscles cause the piriformis muscle to shorten and contract strongly. When the external abductor muscles do not function properly, tension would load onto the piriformis muscle. An increase of more than 40% in the size of the piriformis muscle would lead to compression of the sciatic nerve. A spasm of the piriformis muscle not only compresses the sciatic nerve but also leads to compression of the pudendal nerve. The pudendal nerve controls the bladder and intestinal muscles. Such patients may have tingling and numbness in the groin and buttock areas, and urinary and fecal incontinence. The piriformis muscle may cause gluteal pain spreading to the leg by stimulating the sciatic nerve. If there is involvement of the posterior cutaneous nerve of the thigh, pain may spread from the thigh to the knee. Pain usually increases with longer sitting (driving, cycling), or on standing up from a seated position. Because the piriformis muscle is adjacent to the lateral pelvic wall, pain can occur, with increased bowel movements. Dyspareunia can occur in these patients. There may be a history of limping, scuffing and numbness in the lower part of the leg on the affected side. In the majority of patients, an anterior oblique rotation towards the contralateral side is seen in the sacrum on the side of the affected piriformis muscle (e.g. left oblique rotation and right anterior rotation if there is a problem on the right side). This results in a compensatory rotation towards the affected side in the lower lumbar vertebrae (Fig. 1). TePoorten reports that patients with piriformis syndrome may have a decreased range of motion in the T10 and T11 vertebrae, tissue structure changes and a decreased range of motion in the T3 and T4 vertebrae, pain and decreased range of motion at the C2 level on the contralateral side, and lesions in the atlanto-occipital transition on the ipsilateral side.

Three factors must be considered with regard to pain caused by piriformis syndrome: (i) referred pain due to trigger point development in the piriformis muscle; (ii) sciatica due to irritation of the piriformis muscle; and (iii) SIJ dysfunction. As is known, spasm, trigger point and tension problems in muscle occur as a result of latent acidosis and lymphatic dysfunction due to impaired perfusion and unremoved degradation products. In the case of continuation of latent acidosis caused by degradation products resulting from inflammation, this increases the body burden and prepares the ground for vegetative burden and the deterioration of the systemic structure.

**Symptoms**

Pain can occur when standing, sitting or lying down in the same position for 15 - 20 minutes. Pain spreading from the sacrum into the gluteal region and generally the knee can occur. It can mimic radicular pain owing to irritation of the sciatic nerve. Pain increases with movement, and decreases with rest. When standing up from a seated position or when squatting, pain increases. It does not completely disappear with position change. Pain may occur in the contralateral SIJ. Walking difficulty (antalgic gait, drop foot) can occur, as well as foot numbness and weakness in the lower extremity on the affected side, headache and neck pain, pain in the abdominal, pelvic and inguinal regions. Dyspareunia may occur in women. Pain increases with bowel movements.

**Examination findings**

The following may be found:

- tenderness with palpation in the SIJ, greater sciatic foramen and piriformis muscle
- tenderness over the piriformis muscle
- palpable mass at the anatomical location of the piriformis muscle
- reduction of pain on applying traction to the problematic leg
- asymmetric weakness in the problematic leg
- Pace test (FAIR (flexion, adduction, internal rotation)) positive
- Lasegue test positive
- Freiberg test positive
- Beatty test positive
- internal rotation of the lower extremity on the affected side restricted
- short leg on the affected side
- gluteal atrophy (in chronic cases)
- compensatory lumbar rotation with permanent sacral rotation towards the contralateral side.

The causes of lower back pain and sciatica should be considered in the differential diagnosis. Patients with piriformis syndrome who do not usually have neurological deficits are assessed as herniated nucleus pulposus, and thus misdiagnosed. Other conditions that cause spinal stenosis, facet syndrome, SIJ dysfunction, trochanteric bursitis, myofacial pain, pelvic tumour, endometriosis and sciatic nerve irritation should be considered.

**Treatment**

Non-invasive methods are preferred in the treatment of piriformis syndrome. Paracetamol and nonsteroidal anti-inflammatory drugs are recommended for pain control. Particular exercises should be added to the treatment as an absolute requirement. Piriformis stretching, sacroiliac mobilisation hamstring stretching and pelvic floor muscle exercises should be included in treatment programmes. The entire protocol should be organised as 10 repetitions, twice a day. Electrotherapy, trancutaneous electrical nerve stimulation and low-level laser treatments are physical therapy modalities that can be applied to increase blood flow.

Fig. 1 Appearance of piriformis muscle injection under ultrasound.
Piriformis muscle injection

In cases such as trigger point and piriformis spasm that are not resolved by systemic drug use, piriformis muscle injection is frequently used, both to clarify diagnosis and to provide treatment.[19,14]

Blind technique

The patient is placed in the prone position. The distance between the greater trochanter and the SIPS is divided into two equal parts. The precise trigger point is fixed between two fingers, and the injection is performed. To avoid contact with the sciatic nerve in this region, the needle should be inserted laterally into the piriformis muscle (the greater trochanter and SIPS is divided into three equal parts, and the injection is performed medially from the lateral third). During advancement of the needle, the person injecting should remain in communication with the patient and should question whether there is a feeling of electric shock or numbness. It is expected to reach the muscle at a depth of ~2.5 - 5.0 cm. Sciatic nerve penetration is the most feared complication in this injection. The procedure should therefore be performed by an experienced physician or someone experienced in the technique.[14]

In a cadaver study conducted to determine the exact placement of the sciatic nerve in this region, it was found that the mean (standard deviation; range) distance between the lower edge of the S1J and the sciatic nerve was 2.9 (0.6; 1.8 - 3.7) cm laterally and 0.7 (0.7; 0 - 2.5) cm caudally. The width of the sciatic nerve was measured as 1.5 (0.3; 1 - 3.5) cm.

In operations performed under fluoroscopy, the needle is vertically inserted from the midpoint of the distance between the great trochanter and the SIPS. The spread of contrast medium within the muscle is observed, and then local anesthetic injection is performed.[25]

Rarely, surgical release of the piriformis muscle in difficult cases is among the treatment options.[20]