ORIGINAL ARTICLE

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ADVANCED SURGICAL AND THERAPEUTIC TRENDS IN THE TREATMENT OF CHRONIC SACROILIITIS IN NEUROSURGERY

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Abstract. *The sacroiliac joints are among the largest joints in the human body. They are subjected to heavy loads on a daily basis. The pathology of the sacroiliac joints can be easily missed due to the many common and overlapping symptoms with other diseases in this area. The thin joint capsule, the high mechanical load, and the asymmetrical movement of the pelvic girdle explain the frequent involvement of the sacroiliac joint. Chronic degenerative processes in the joint may result from rheumatic, infectious, drug-dependent and oncological causes. Diseases such as ankylosing spondylitis, psoriatic arthropathy, Bechet's disease, hyperparathyroidism and various pyogenic causes also cause changes in the joint. Hormonal changes during pregnancy and being overweight are predisposing factors for the development of chronic sacroiliac arthritis. According to the literature, 10-25% of the pain in the area is due to sacroiliac joint pain. Due to the often irradiating pain in different directions, a correct diagnosis is difficult. The therapy of chronic sacroilitis is continuously improving due to the high social importance of this disease. Twenty-eight patients were treated in the Department of Neurosurgery of Pulmed University Hospital with hyaluronic acid injection and corticosteroid blockade, under X-ray control in both sacroiliac joints. Preoperatively, the patients were evaluated using neurological examination and the Oswestry Disability Index, VAS, and "Facial Pain Rating Scale" scales. The results after the minimally invasive methodology showed an excellent response to the pain syndrome. Follow-up of the patients continued up to nine months after the manipulation.*

Key words: *sacroiliac joint anatomy and biomechanics, medical treatment, minimally invasive treatment*

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INTRODUCTION

Chronic sacroiliitis is an inflammation of the sacroiliac joints, which is often associated with diseases of the group of seronegative spondyloarthropathies, such as ankylosing spondylitis and psoriatic arthritis. The disease is characterized by prolonged low back pain, stiffness, and functional limitation that can significantly impair patients' quality of life [1, 3, 4].

Traditionally, treatment includes conservative methods such as non-steroidal anti-inflammatory drugs (NSAIDs), physiotherapy and immunosuppressive therapy [10, 12]. However, in some patients, symptomatology remains persistent and more aggressive therapeutic approaches are required, including intra-articular administration of hyaluronic acid and corticosteroid under image-guided, surgical intervention [13-15]. Over the past decade, medical science has made advances in both the diagnosis and treatment of sacroiliitis. The development of biologic agents, as well as minimally invasive surgical techniques, has opened new avenues for controlling inflammation and improving functional capacity [6, 10, 18, 19, 20]. The aim of the present study is to analyze current trends in the therapeutic approach to chronic sacroiliitis, focusing on the role of surgical treatment in the comprehensive approach to the disease.

MATERIALS AND METHODS

During the period March 2023 – March 2024, 28 patients with chronic sacroiliitis were diagnosed in the Department of Neurosurgery at Pulmed University Hospital by physical examination and diagnostic imaging. The latter were staged using the Oswestry Disability Index, VAS (Visual Analogue Scale of Pain) and the „Facial Pain Rating Scale". Only patients with involvement of both sacroiliac joints were included in the study. The values of the VAS scale and „Facial Pain Rating Scale" were distributed in a scoring system as follows:

0-1 – no pain, no pain (no difficulty in daily life);

1-3 – little pain (difficulty in daily life);

3-5 – moderate/medium pain (difficulties and/or limitations in daily life);

5-7 – severe pain (limitations in daily life);

7-9 – very severe pain (limitations and/or inability to function in daily life);

9-10 – terrible/unbearable/unbearable pain (inability to function in daily life).

The distribution of patients by sex, age, and pain severity according to the different scales can be presented graphically in the following table:

Preoperative imaging by computer-assisted tomography (CAT) and magnetic resonance imaging (MRI) was also a consideration in the diagnosis of the patients. Each patient underwent an MRI of the lumbar spine and sacroiliac region to exclude pathology in the lumbar spine. The characteristic inflammatory responses on the bone side in the presence of ankylosing spondylitis are presented in Figure 1.

Table 1. Shows the distribution of patients by gender, age and pain severity

Male/female sex	Ages	Oswestry Disability Index pain score	VAS pain assessment	Pain assessment on a "Face scale"
Men (12 patients)	63+/- 2 years old	21% – 40% moderate disability	5-7 severe pain (limitations in daily life)	3-5 moderate/medium pain (difficulty or limitations in daily life)
Women (16 patients)	66+/- 2 years old	21% – 40% moderate disability	5-7 severe pain (limitations in daily life)	5-7 severe pain (limitations in daily life)

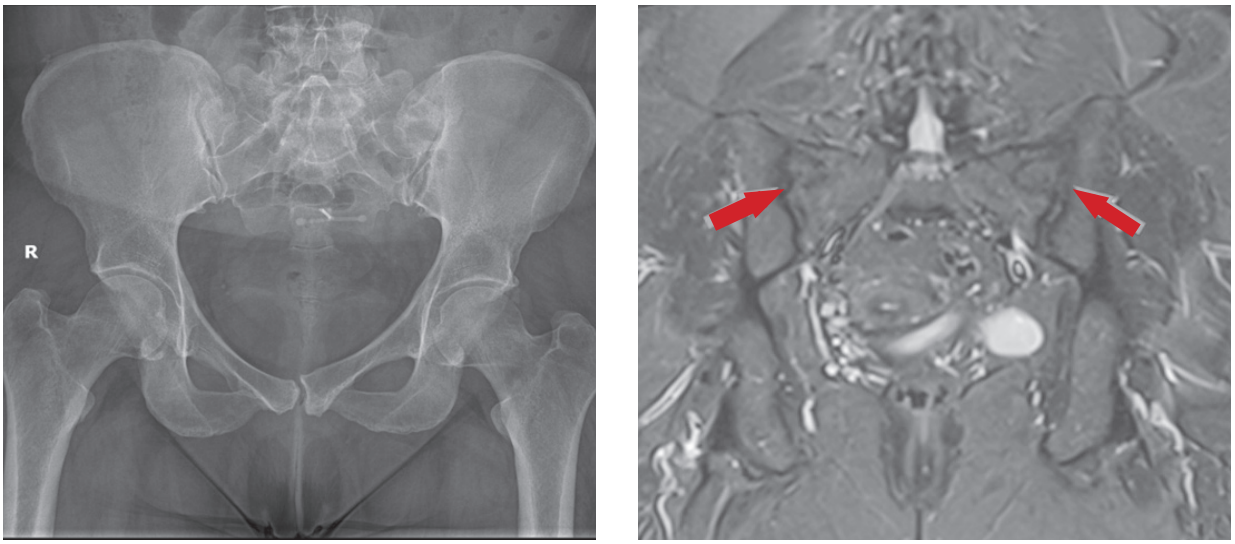

Fig. 1. Radiograph and MRI of the lumbar spine and sacroiliac region, presenting degenerative changes in the joint

The treatment of the patients was performed using a minimally invasive method in the operating room, observing the rules of asepsis and antisepsis. Patients were anesthetized by local infiltration with Lidocaine 20 mg/ml. The technique of the performed manipulation consisted of infiltration of the sacroiliac joint under radiological control (for this purpose, phase X-rays were used with a C-arm model „FYS3360A“ with a radiation source of 0.002 mGy/h) with the placement of 2 ml of hyaluronic acid in each joint, followed by 7 mg/ml. Flosterone. The manipulation ends with a sterile dressing of the surgical wounds. In the treatment protocol we established, patients had to perform bed rest for 30 to 60 minutes after the manipulation was performed, after which they were verticalized and ambulated independently.

RESULTS

Postoperatively, patients were monitored and assessed by applying the original pain rating scales. The study continued for 9 months after the manipulation. Patient assessment on day seven showed the following results: relative to the Oswestry Disability Index, both study groups had average pain severity scores of 0-20% (minimal disability), indicating the patients could manage activities of daily living. Similar results were observed for the VAS and the „Facial Pain Rating Scale“, where patients rated their pain in the range: 0-1 – no pain, no pain (no difficulty in daily activities). Similar results were observed in the study cohort in the first trimester. During the second trimester of follow-up, 3 of the men reported, and were assessed as having, recurrent pain and values similar to baseline. Similar complaints were recorded in 2 women. During the third trimester of follow-up, 8 men and 10 women were reported to have fully responded to the treatment.

Interpretation of the results indicates that the best effect was achieved in the first 3 months after the manipulation was performed. At the sixth month, the percentage of patients who had no pain remained high, although between the 6th and 9th months, the study population that responded to the surgical treatment dropped compared to the first trimester. Despite these results, our conclusion is that the method used shows good results for the treatment of chronic sacroiliitis in both sexes. Graphically, the results are presented in Figure 2.

DISCUSSION

Axial spondyloarthritis is a chronic systemic inflammatory disease. Sacroiliitis is a part of these diseases that can have different etiologies and be of different types [1, 2]. The embryonic development of the joint occupies an important place. The sacroiliac joint

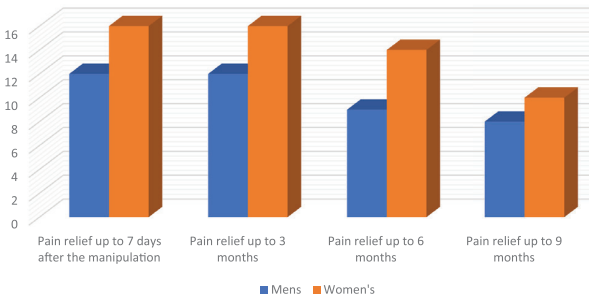

Fig. 2. Graphical depiction of postoperative outcomes in treated patients in absolute values affected by the treatment.

is formed in the second month of gestational age, a thin fibrous capsule is formed in the fifth month, and in the 37th gestational week, the synovial membrane covers the joint capsule. The first decade of an individual's development is associated with proportional growth of the joint and the development of fibrous cartilage, whereas in the second and third decades, the articular surfaces begin to become uneven and prominent edges appear on the iliac surfaces [2].

The sacroiliac joint is a semi-mobile joint that connects the sacrum to the two pelvic bones. The facies auricularis of the os sacrum and the facies auricularis of the os ilium serve as the articular surfaces. They correspond in shape and relief and are covered with hyaline cartilage. The cartilage of the os ilii is twice as thin and more often shows degenerative changes [1, 3, 4]. The articular capsule is short and attaches at the edges of the articular surfaces. The articular ligaments are anterior, posterior and interosseous. The anterior ones fuse with the superior and inferior regions of the joint. The posterior ones are more numerous, thicker and consist of short and long bundles. The short bundles lie deep and attach to the posterior surface of the sacrum, partially covering the foramina sacralia posteriora [2-5]. The long ligaments are located more superficially. They descend obliquely from the tuberositas iliaca to the middle part of the crista sacralis lateralis, becoming entwined in the fibers of the lig. sacrotuberale. As lig. iliolumbale are designated the fibres which start from the processus costalis of the 5th lumbar vertebra and end at the crista iliaca. Deepest between the tuberositas sacralis and tuberositas iliaca are ligg. sacroiliaca interossei [1, 3, 4]. The capsule of the sacroiliac joint is relatively thin, and defects are often seen here through which synovial fluid or pus leaks into the surrounding structures. The sacroiliac joint is subjected to continuous stress and strain. It consists of two parts: the syndesmosis and the synovial part [4, 5, 6].

Fibrous adhesions and mild obliteration are seen in both sexes, earlier in men and after menopause in women. It usually occurs after age 50 [1, 2, 5]. In adult individuals, the joint may be completely fibrosed and sometimes even ossified. Changes in the sacroiliac joint can cause low back and sciatic pain [2, 7, 8, 9]. The diagnosis of pain originating from this joint is quite difficult because the same complaints can be caused by disease of other anatomical structures. Usually, patients with pathology in the joint report pain below the level of the 5th lumbar vertebra, and most often it is localized around the position of the spina iliaca posterior superior. Similar complaints were reported by patients in our study group. During pregnancy, the joints and ligaments of the pelvic girdle loosen under the influence of the hormone relaxin. The range of motion in the joints increases [5, 7, 8, 10, 11]. The sacroiliac joint has important relationships with neighboring organs. The internal and external iliac veins connect to form the common iliac vein immediately anterior to the joint. Thus, they separate the joint from the bifurcation of the common iliac artery, and more anteriorly from the ureter [1, 2, 3, 5, 7]. The lumbosacral trunk and n.obturatorius are located along the anterior surface of the joint behind the vessels. M. piriformis partially traps the anterior surface of the joint capsule, separating the joint from the upper part of the plexus sacralis [1-5]. This anatomical proximity influences the clinical picture and creates conditions for the involvement of adjacent anatomical elements. The close relationship of the joint with the neural elements also explains the irradiation of pain in different directions [5, 6].

Depending on the etiology, sacroiliitis can be rheumatic, infectious, drug-induced, or oncological [9-11]. Ankylosing spondylitis, psoriatic arthropathy, Bechet's disease, hyperparathyroidism and various pyogenic causes may accompany it. Inflammatory sacroiliitis may be secondary to osteoarthritis, pregnancy, or trauma. Clinical manifestations include low back pain, stiffness, and, at a later stage, restriction of movement. Benjamin Buchanan and Matthew Varacallo report that only 10% to 25% of all low back pain is due to sacroiliac pain. In up to 50% of these cases, the pain radiates to the lower extremity, in 6% it radiates to the lumbar region, in 4% to the inguinal region, and in 2% to the lower abdomen [10-13]. Pain most commonly radiates to the L4-L5 dermatomes, but it can also extend over the L2 or below the S3 dermatomes. Over the years, various criteria have been published for the diagnosis. In the literature, the Rome criteria of 1961 and the New York criteria of 1984 are known. The discovery in 1973 of the close association of the HLA-B27 leukocyte antigen and spondyloarthritis was very significant [9, 12-14]. In 1990, new Amor criteria were published and adopted by the European Spondyloarthropathy Association. The more important ones are [6, 8, 10]:

A. Past or present clinical manifestations
   1. Back pain at night and/or morning stiffness
   2. Asymmetric oligoarthritis
   3. Permanent or alternating gluteal pain
B. Detection of changes on imaging
C. Predisposing genetic factors
D. Positive reaction after administration of appropriate therapy

Walter Maksymowych, Roebert Lambert et al. reported capsulitis, enthesitis, and lesions and erosions of the tissue surrounding the joint. They also introduced

a new definition including: subchondral infiltration, presence of fluid in the joint, erosion of the joint cavity, ankylosis, and bone buds [6, 8, 11].

The most common symptom is low back pain, with pain being strongest in the morning and diminishing after movement, the latter increasing after standing in a sitting position for a long time and when climbing stairs or crossing the legs. Most patients report a sharp, dull or stabbing pain that spreads from the lower back to the buttock area, and there is often a feeling of stiffness in the morning that lasts for more than an hour each time after waking. One of the most common symptoms is a change in gait [8, 10, 12]. Sacroiliitis is difficult to diagnose and therefore resembles the symptoms of lumbar disc herniation, coxarthrosis, and sciatic nerve inflammation. All this leads to incorrect treatment and delay in diagnosis [5, 7, 8, 14].

Diagnosis is made by a thorough physical examination of the patient and the use of diagnostic imaging modalities, the most commonly used being: pelvic radiograph, computed axial tomography (CAT), magnetic resonance imaging (MRI) [8, 9]. Typical findings on sacroiliac joint radiographs are: sclerosis, erosion, pseudodilatation, and bone bridging. CT diagnosis shows similar changes as radiographs, but with much greater detail when illustrating bony structures. Sclerosis, narrowing of the articular cleft, erosions and ankylosis are again seen. The greatest advantage of the MRI scan is the clear visualization of detailed anatomy, pathologic changes, and the focus of inflammation. The image that is obtained includes the abnormalities of the periarticular soft tissues that are only indirectly visible with other methods. Chronic structural changes of the bone and joint are very well visualized, such as periarticular fatty tissue accumulation, subchondral erosions, sclerosis, bone bridges, and ankylosis. Detection of periarticular fatty tissue deposits is particularly important because other imaging modalities do not visualize these deposits. MRI is not associated with radiation exposure, so it is appropriate for young women, children, and patients with more previous exposure. Patients diagnosed with sacroileitis are considered „MRI positive“ if more than one lesion is visible on a single slide. If only one lesion is present, it should also be present in the next two slides [8, 9, 14-17].

Hyaluronic acid (HA) is one of the main components of the extracellular matrix that plays an important role in the presence of aseptic inflammation in joints associated with the accumulation of HA polymers and cells of chronic nonspecific inflammation. The latter controls the expression of inflammatory genes and the release of cytokines in the process of inflammation. It has been shown that upon local placement of exogenous HA in the sacroiliac joint, metabolic processes are initiated by synthesis and accumulation in the cartilaginous parts of the latter. In normal tissues, HA is in the form of a high molecular weight compound (HMW-HA) that inhibits angiogenesis by reducing the proliferation and migration of endothelial cells and the expression of inflammatory reactions. Research has shown that HMW-HA blocks T cell precursors and produces IL-10, thereby reducing the inflammatory response [15-20].

CONCLUSIONS

Surgical treatment of chronic sacroiliitis with intra-articular administration of corticosteroids and hyaluronic acid has shown promising results in terms of pain reduction, improved functional capacity and quality of life in patients. The combined approach allows both controlling the inflammatory process through corticosteroids and hyaluronic acid and providing structural and metabolic support of the joint. Despite our clinical observations in the study cohort, further randomized clinical trials with a larger number of patients and long-term follow-up are needed to validate the efficacy and safety of this therapeutic strategy. Scientific evidence suggests that the sacroiliac joint anatomy is under severe stress, resulting in pain and subsequent disability, which has been successfully addressed by intra-articular fluoroscopic navigation, hyaluronic acid administration and flosterone.

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Institutional Review Board Statement: *The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of Pulmed University Hospital for studies involving human subjects. Each of the patients included in the observational study gave their verbal consent to the treating physician that they agreed to be treated in the manner described, having been informed in advance of the benefits and possible risks of the procedure. No complications were observed during or after the procedure.*

Informed consent statement: *Verbal informed consent was obtained in the presence of each of the authors of the scientific article from all participants in the study.*

Conflicts of Interest: *There is no conflict of interest in the scientific article presented.*

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