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Research Article

Lesions in Medical Imaging of the Motor System versus Coccygodynia

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Abstract

Objectives: The objective of this work is to determine the correlation and concurrence of lumbar and thoracic spine lesions, which can be observed in medical imaging (x-ray, MRI and CT), with coccygodynia.

Method: The study was of a retrospective nature. Therein, the study group (group A) and the control group (group B) have been compared. The group A consisted of 123 people suffering from coccygodynia. The group B consisted of 123 people, where not a single person has ever complained about coccygodynia. Both groups were diagnosed and treated in Center of Manual Therapy (CTM) in Sierosław, Poland. All patients have been examined and treated according to the guidelines of Manual Therapy by Rakowski. The results obtained from the review x-ray images of lumbar and thoracic spine as well as MRI and CT of lumbar spine of both groups patients were analysed. The following structural lesions were observed in medical imaging tests. Also, they were further submitted for statistical analysis: sacralization of L5, lumbarization of S1, vestigial ribs at T12 or additional ribs at T13, spina bifida, thoracic and lumbar scoliosis, reduction of intervertebral space in the lumbar spine, Baastrup's sign, osteophytosis, spondylolisthesis, herniated and protruded nucleus pulposus in the lumbar spine.

Results: When identifying the relationship between coccygodynia and thoracic spine lesions we were clearly able to indicate the concurrence of scoliosis. It was 3.7 times more frequent in people with coccyx pain (p=0.0007). However, when examining the concurrence of coccyx pain and lesions observed in MRI and CT we were able to show the cause and effect relationship between coccygodynia and herniated nucleus pulposus at L5/S1. Herniation at L5/S1 was around 1.4 times more frequent in people with coccyx pain (p=0.0058).

Conclusion:

- Lesions in medical imaging indicate the cause and effect relationship between coccygodynia and thoracic spine scoliosis as well as herniated nucleus pulposus at L5/S1.
- In addition to tests focused on the local problem, the diagnostics of coccygodynia should include medical imaging of lumbar and thoracic spine.
- Diagnostics and therapy of coccyx pain should incorporate more than just local causes of coccygodynia.
- For patients with coccygodynia, a prospective study should be planned according to an established protocol specifying the clinical study method and the extent of medical imaging.

Keywords: Coccygodynia; Medical imaging in coccygodynia; Structural lesions of the motor system versus coccygodynia

Introduction

Diagnostics of coccygodynia offers many tests focused on imaging of the sacrococcygeal region, the sacrosciatic joint or individual coccyx segments using x-ray, MRI, CT or ultrasound. Several works based on image analysis were produced. They are case studies [1] as well as studies with large patient groups involved [2-8]. Coccyx mobility rating scales described by Maigne [3,9] as well as Postacchini and Massobrio [10] have become widespread. Those rating scales are helpful in disorder assessment

in a given region, but they do not provide data needed to choose a procedure - be it a conservative or a surgical one. This is because coccygodynia causes can be remote [11-13]. It is well known that only a portion of the lesions observed in medical imaging tests have their clinical manifestation [7,11,14-15]. This is also found in case of coccygodynia. That's why the wider view seems important, one not just limited to the location of the problem at hand. One way to expand the causal diagnostics of coccygodynia is to carry out medical imaging tests such as summation x-ray, MRI or CT of lumbar and thoracic spine. During those tests, it seems, cause and effect relationship between coccygodynia and the observed structural lesions of the motor system, which lie remotely to the symptom manifestation area, becomes apparent.

Materials and Methods

123 patients suffering from coccygodynia were examined (the study group A). They all reported to Center of Manual Therapy (CTM) in Sierosław (Poland). The participants were selected from 13,793 patients with various motor system conditions. A control group was selected (the group B) from the above group as well. The group also included 123 patients, who never complained about coccygodynia. However, those patients suffered from various conditions of the lumbar and lumbosacral spine, pain in the lower limbs region, pain in the pelvis region or functional conditions of internal organs. All patients have been examined and treated according to the guidelines of Manual Therapy by Rakowski [11]. In the Manual Therapy by Rakowski approach the main cause of primary motor system conditions is static overload resulting from long-lasting, chronic compression or traction. Connective tissue structures react to those forces and as a result they change their functional state. The static overload very often makes the following structures dysfunctional: interspinous and supraspinous ligaments, joint capsules of individual motion segments of the spine and ligaments of the sacroiliac joint (sacroiliac, sacrotuberous and iliolumbar ligaments), head-neck junction structures and others that closely interact with them. Each dysfunctional structure takes on a number of characteristic features: it generates disorder-specific symptoms, it has tissue memory, it gives access to afferences, it creates areas with reduced resilience to overload [11].

Our study was of a retrospective nature. The data was obtained from patients' files and collected in the study protocol, added to a spreadsheet, and finally submitted for statistical analysis in order to find cause and effect relationship between the coccyx pain and the factors examined. The examination results obtained from the x-ray images of lumbar and thoracic spine as well as MRI and CT scans of lumbar spine of coccygodynia patients and of the control group were analysed. These were additional examinations in both groups because of the diagnostics of the described problem or because of other conditions being present. Acquired and congenital structural lesions have been taken into account. The congenital structural lesions further submitted for statistical analysis were: sacralization of L5, lumbarization of S1, vestigial ribs at T12 or additional ribs at T13, spina bifida. The following acquired structural lesions were analysed in this work: thoracic and lumbar scoliosis, reduction of intervertebral space in the lumbar spine, Baastrup's sign, osteophytosis, spondylolisthesis, herniated and protruded nucleus pulposus in the lumbar spine.

Limitations of this study was the fact that tests were carried out on various devices and assessed by different persons. Another limitation was the comparison of results which were obtained in non-uniform tests - some patients had x-ray, some had MRI and others had CT test. With regard to the above non-uniformities appropriate statistical tools were adapted in order to improve the reliability of results.

Results

When identifying the relationship between coccyx pain occurrence and the lesions observed in medical imaging such as x-ray, MRI, and CT it could be shown that there is a relationship between coccyx pain occurrence and the lesions observed in x-ray images. This is shown on Figure 1. Noteworthy is the relationship between coccygodynia and lesions in the thoracic spine. Scoliosis in this area was around 3.7 times more frequent in people suffering from coccyx pain. The relationship strength amounted to p=0.0007, with chi-quadrant tests carried out and the Bonferroni amendment: p=0.05/44=0.0011.

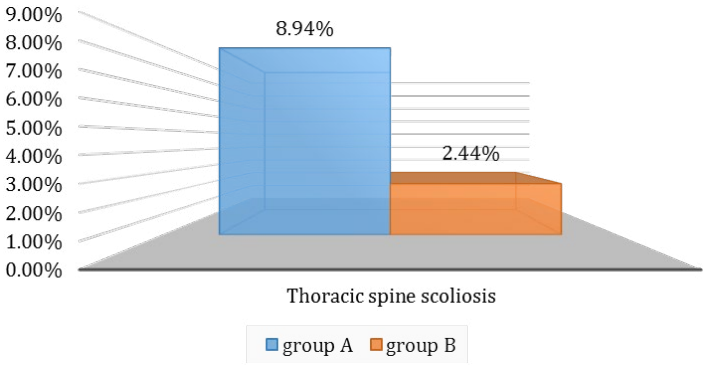

Figure 1: Thoracic spine scoliosis versus coccyx pain.

When identifying the relationship between coccyx pain occurrence and the lesions observed in MRI and CT it could be shown that there is a relationship between coccygodynia and herniated nucleus pulposus at L5/S1. This is shown on Figure 2. This lesion was around 1.4 times more frequent in people with coccyx pain and remains in a statistically significant relationship. The relationship strength amounted to p=0.0058, with chi-quadrant tests carried out and the Bonferroni amendment: p=0.05/5=0.01.

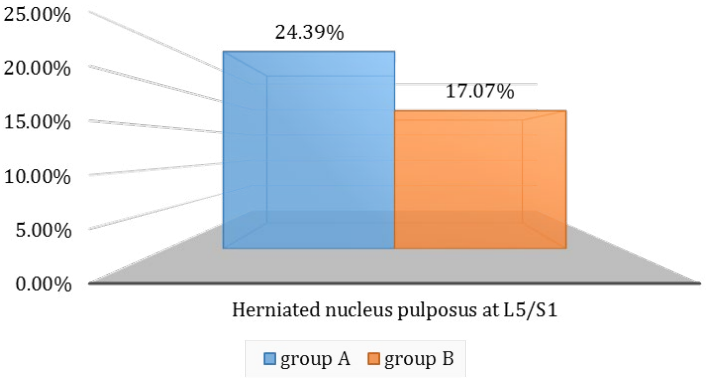

Figure 2: Herniated nucleus pulposus at L5/S1 versus coccyx pain.

Other features, which were submitted for statistical analysis, were not in statistically significant relationship with coccygodynia.

Discussion

The literature on this subject lacks data indicating links between coccygodynia and structural lesions occurring remotely. It is a difficult and demanding study subject, not only for organisational and financial reasons, but also because it is very rare to consider other than just local causes of coccyx pain. There were several studies on the anatomy of sacrum-coccyx junction and its relationship with coccygodynia [4-5,7-8,12,16]. Researchers point to the fusion of the first coccyx segment (sacralization) with the last sacrum segment as one of the possible causes of coccygodynia. This formation can be seen at the level of coccygeal horns or transverse processes of the first coccygeal vertebrae. It is believed that the specific anatomical structure may be one of the causes of mechanical coccygodynia, including by entrapment/compression of the neural structures of this region [6,16]. However, most studies focus on such coccyx parameters as: width, length, thickness, sacrococcygeal angle and the angle between individual coccyx segments as well as lateral deviation angle [4-6,10]. Reports on this matter are inconclusive; they show certain correlations, however acknowledging them as reliable in coccygodynia diagnostics would not be correct due to existing anatomical variety, which depends on various factors: gender, age, BMI, past injuries or childbirths.

In one study, the authors suggest there is little usefulness in producing radiographs of sacrum and coccyx, because small percentage, only 8.4% +- 2.1%, provides confirmation of structure damage and symptom manifestation [17].

In our work we showed links indicating concurrence and correlation of coccygodynia and thoracic spine scoliosis. It means that thoracic spine disorders can trigger coccygodynia. Coherent with this observation is also the result showing strong, statistically significant relationships of mid-thoracic spine pain as well as shoulder blade region pain with coccygodynia [13]. Thus, when addressing the coccyx pain we should consider structural and pathological lesions as well as the functional state of this segment of the spine. The following structures are meant here: supraspinous ligament, interspinous ligament, periarticular tissues of facet joints, the erector spinae, including iliocostalis [11], or thoracolumbar fascia, all of which can transmit information beyond their anatomical region. Others note the need for attention to the links between the described problem and the diaphragm, upper thoracic orifice structures and abdominal organs [18]. Hypotheses referring to the ways of transmitting information in the body have been described in the article: [13].

Another interesting result obtained in our study indicates the existence of the relationship between coccyx pain and herniated nucleus pulposus at L5/S1. Thus, it is likely that the presence of an herniated nucleus pulposus at the level described may not only generate intrinsic root symptoms, but may also provoke other symptoms from the motor system, including coccygodynia. I would like to stress that not a single group A person felt acute pain because of the root-disc conflict, which had been confirmed in the neurological and manual examination. Such a result corresponds to other studies conducted by the author in CTM, in which reduction of intervertebral space at L5/S1 correlated in statistically significant way with coccygodynia [12,19]. This shows the relationship of a motion segment of the spine to the symptom in question, because the mere reduction of intervertebral space at L5/S1 is not information which proves the root-disc conflict, but only information about the pathology of the intervertebral disc. This is confirmed by various researchers who see the cause of coccygodynia as discopathy [20-23] or lumbar spondyloarthrosis [21]. Also, others confirm these observations by finding proofs of pathological intervertebral discs in the lumbar spine in 48% of patients with coccygodynia [7], without existing clinical symptoms at the levels where the discopathy is observed. It has also been noticed that lumbar spine operations or the administration of epidural anaesthesia can trigger coccygodynia [22]. Others have reported radiating pain to the coccyx during stimulation of L3-S1 motion segments [24], while stimulation at L2 may have good results in the treatment of coccygodynia [25]. It has also been noted that in people with coccyx pain the concurring condition is the lumbar spine pain [12,25-27]. Such pain can also be the result of the referred pain originating in joints and muscles of the lumbar spine [11]. So, the importance of the remote causes of coccygodynia needs to be investigated, including the spinal motion segment syndrome with its active and passive structures [11]. In the future, it is worth considering to arrange medical imaging of pelvis including hip and sacroiliac joints. Indeed, in patients with ankylosing spondylitis coccygodynia has been shown to be three times more frequent than in people with the chronic, non-specific

lumbar and lumbosacral spine pain complaints [28].

We should not only find the morphological lesions concurring with coccygodynia, which are present in upper spine regions and perhaps in the future also within pelvis, but we should also examine dysfunctional structures. Structural lesions result in a number of functional changes which unfortunately we cannot see in medical imaging. These include: excessive tissue tension, tissue stiffness, excessive sensitivity to pressure (soreness during palpation), decreased mobility, decreased shift. Only by means of manual examination can we pick up these changes and adjust the appropriate therapeutic stimuli used in manual therapy. This provides the opportunity to obtain a clinical response by analyzing both the immediate effect (after the introduction of the therapeutic stimulus) and the effect some time after the completion of the manual treatment. Therefore, we should keep in mind that the structural lesions visible in medical imaging at the level of individual anatomical structures may not give clear indications for specific targeted procedure. However, it can be a hint where to look for dysfunction in the motor system. When we find structural lesions in the thoracic or lumbar spine, for example, we should examine adjacent tissues to see if they remain dysfunctional and affect coccygodynia. This becomes possible with the techniques used in Manual Therapy by Rakowski - including compression mobilizations from both external access and per rectum access, or joint mobilizations and verification of the symptom by what is called a control test. It is any active or passive movement that reproduces the patient's known conditions and can verify the therapeutic procedure applied. Combining the findings of objective medical examination of structures lying remotely to the site of coccygodynia with manual examination can make the process of diagnosis, functional examination, and manual treatment of coccygodynia more effective. On the other hand, it can lead on the basis of exclusion to a quicker diagnosis of causes which can be treated pharmacologically or surgically, as well as indicate the causes of conditions, which are contraindications to manual treatment.

Conclusion

- Lesions in medical imaging indicate the cause and effect relationship between coccygodynia and thoracic spine scoliosis as well as herniated nucleus pulposus at L5/S1.
- In addition to tests focused on the local problem, the diagnostics of coccygodynia should include medical imaging of lumbar and thoracic spine.
- Diagnostics and therapy of coccyx pain should incorporate more than just local causes of coccygodynia.
- For patients with coccygodynia, a prospective study should be planned according to an established protocol specifying the clinical study method and the extent of medical imaging.

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