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Modern Approaches to the Diagnosis of Combined Degenerative-Dystrophic Pathology of the Hip Joint and Spine

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Abstract

Thereis no need to further develop issues related to the diagnosis of coxo-vertebral syndrome and treatment of this category of patients [12]. With the advent of modern highly informative methods of structural and functional radiological visualization of the "hip joint – pelvis – spine" complex (vertebral-pelvic complex), new prospects have opened up for the full diagnosis of various variants of its static deformities. However, the sensitivity and specificity of radiological criteria used today as routine examination methods for this category of patients do not fully meet the needs of practical orthopedics. At the same time, the role and place of special radiological studies in modern clinical practice have not been definitively established.

It is necessary to search for methods of additional examination of patients in order to determine the nature and scope of structural and functional changes in this kinematic chain, as well as to develop an algorithm for complex diagnosis of combined pathology of the hip joint and lumbosacral spine. The aim of the study was to improve the results of diagnostics of pathological changes in the "hip joint – pelvis – spine" complex in patients with coxo – vertebral syndrome by creating an examination algorithm based on clinical and radiological positions.материалmaterial and methods 90 patients (59 men and 31 women) with a combination of degenerative-dystrophic pathology of one or two hip joints and the lumbosacral spine with a predominance of coxarthrosis (stage III) were examined. The criterion for inclusion in the study was the presence of pain syndrome both in the hip joint (s) and in the lumbosacral spine. The exclusion criteria were: the presence of pain syndrome caused only by the pathology of the spine; degenerative-dystrophic lesion of the hip joints without pain in the spine; all variants of dysplastic scoliosis and spondylolisthesis; Scheuermann – Mau disease; spinal injuries; any inflammatory diseases in the hip joints and spine; tumors; dysplasia and abnormalities of the spine that can cause its deformity or pain syndrome. Among the examined patients, dysplastic coxarthrosis was diagnosed in 19 (21%), aseptic femoral head necrosis (ANGBC) – in 40 (44%), idiopathic and post-traumatic deforming osteoarthritis occurred in 21 (23%) and 10 (11%) patients, respectively. The age of the subjects ranged from 27 to 78 years and averaged 54.31±11.77 years. Patients were divided into four comparison groups according to the typeof Global lumbar lordosis (lordosisGLL) according to the P. Roussouly classification with co-authors [2]. The general condition of the subjects was studied on the basis of data from clinical and laboratory studies. To assess the orthopedic status of patients with coxo-vertebral syndrome, the diagnostic complex also included: clinical and neurological examination and methods of additional instrumental examination [16]. Digital calibrated radiographs were examined using eFilm eFilm Workstation 2.1.0 and medi CAD software. To determine the type of lumbar lordosis, 9 parameters were measured on the obtained electronic lateral radiographs, of which 3 were pelvic and 6 were vertebral. The following pelvic parameters were used: PI – тазобедренный–pelvic incident; ss-sacral slope; pt-pelvic tiltpelvic tilt. Vertebral parameters: GLL (global lumbar lordosis) – lumbar lordosis measured by the Cobb method; AL (apex of lordosis) – top of lumbar lordosis; UA (upper arc of lordosis) – upper arch of lordosis; LA (lower arc of lordosis) – lower arch of lordosis; IP(inflection point) – highest point of lumbar lordosis (place of its transition to thoracic kyphosis); LT (lordosis tilt– - deviation of lumbar lordosis. If PT and LT were positioned

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posteriorly from the corresponding vertical line, their values were considered positive, and k anteriorly – negative. На The following parameters were evaluated on anterior-posterior radiographs: PO (pelvic obliquity) – pelvic tilt angle and SA - scoliotic deformity of the lumbosacral spine, measured by Кобба (the Cobb angle method, and sO (sacral obliquity) – angle of the sacrum skew relative to the pelvis (Fig. Five degenerative vertebral parameters (osteophytes of the vertebral bodies, osteoarthritis of the arcuate joints, and intervertebral height) were purposefully studied for the severity, localization, and nature of changes in the lumbosacral spine суставов, высота. 1. Scheme for measuring the main pelvic parameters of vertebral-pelvic balance on sagittal radiographs: 1, 2-sacral tilt (SS); 3 – pelvic deviation (PT); 4-hip angle (PI)Results distribution of the examined patients by type of lumbar lordosis in accordance with the classification of P. Roussouly et al. (2022) showed the predominance of the hyperlordotic variant of the sagittal vertebral-pelvic profile Analysis of the data obtained revealed a general tendency for signs of degenerative-dystrophic hip joint lesion to prevail in patients with the considered profile and confirmed the uniformity of the distribution of coxarthrosis different etiologies among patients of the selected groups. At the same time, it was possible to detect a higher frequency of shortening of the affected lower limb and a high proportion of clinical observations with hip muscle hypotrophy in the fourth compared group ($p<0.05$), which indicates more severe changes in the musculoskeletal system in patients of this sample. Assessment of social status, daily activity, and non-stop movement time due to pain in the examined patients did not reveal significant differences in the compared samples ($p>0.05$), but it strongly indicated the presence of serious violations of the most important areas of life. The average results of evaluating patients on the W. Harris and Oswestry scales were 46.8±14.2 points and 40±14.5%, respectively, which indicates a moderate violation of the quality of life of the examined patients. There were also no significant differences in the frequency of signs of neurological deficit among patients with different types of lumbar lordosis ($p>0.05$), and their distribution in the compared groups was uniform and corresponded to the number of the latter. Analysis of the distribution of patients by the nature of relationships in the "hip joint – pelvis – spine" segment showed significant variability in the available types of sagittal profile, combined with a significant spread in the values of the studied parameters. The mean value of lumbar lordosis (GLL) was 57.0±11.2° with a minimum value of 31° and a maximum value of 86°. The hip angle (PI) varied from 29° to 87° and averaged 53.2±11.9°. Variable pelvic parameters-sacral tilt (ss) and pelvic deflection (pt) – ranged from 23° to 69° (average 40.9±9.2°) and from -17° to 33° (average 11.9±9.3°), respectively. The variation of the values of the lower lumbar lordosis arch (LA) corresponded to that for the pelvic tilt (ss), and the value of the upper lumbar lordosis arch (UA) averaged 16.1±6.7° with a minimum parameter value of 1° and a maximum value of 29°. The deviation of lumbar lordosis (LT) ranged from 1°to 21° and averaged 5.4±3.9°. The apex of lordosis was most often located in the body of the fourth lumbar vertebra (L4). The value of the pelvic-sacral angle (rA) varied from 0° to 61° and averaged 35.4±14.9°. A similar range of values was observed for the sacral tilt (PL), the average value of which was 30.2±12.9°, and the minimum and maximum values were 0° and 53°, respectively; and for the sacral position (L) -24.4 mm and 41.6 mm, respectively. such a variation in the values of these parameters in patients with coxovertebral The syndrome was associated with the variability of sacral positions in the sagittal plane. Sagittal vertebral-pelvic relationships in patients with the most frequently occurring third and fourth types of lumbar lordosis in comparison with patients of other types were characterized by the highest average values of sacral tilt (ss), equal to 39.6±2.8° and 53.7±6.8°, respectively ($p<0.05$). A similar trend was found for the value of lumbar lordosis (GLL), which was also maximal in the third and fourth groups of patients ($p<0.05$). It was found that the lower arch of lumbar lordosis (LA) in all clinical cases was equal to the slope of the sacrum (ss) and, prevailing in patients with the third and fourth types of GLL ($p<0.05$), made the main contribution to the formation of the sagittal profile of the lumbosacral spine. The superior arch (UA) was most pronounced and played a dominant role in the formation of lumbar lordosis in patients with the first and second types of GLL that rarely occur. It was also possible to identify a tendency for the top of lumbar lordosis to shift from the body of the fifth lumbar vertebra (L5) to the body of the third (L3) as the value of the GLL parameter increases, which is associated with an increase in the lower arch of lordosis (LA). Analysis of frontal vertebral-pelvic relationships showed that pelvic skew in combination with spinal deformity was the main type of frontal compensatory changes in patients with coxo-vertebral syndrome. Thus, pelvic misalignment (pO) in the frontal plane occurred in 53 patients (58.8%). The average value of the pelvic tilt angle was 2.0±1.4°, with the minimum value of this parameter being 0° (no skew)

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and the maximum value being 8°. Among the examined individuals with pelvic misalignment, in 23 (25.5%) cases, half of the pelvis on the affected side was higher, while in 30 (33.3%) patients, the opposite half of the pelvis was higher. In all clinical cases, pelvic skew was accompanied by the formation of lumbar spine deformity in the frontal plane, while 41 (45.6%) patients were diagnosed with scoliotic deformity, and 12 patients (13.3%) with lateral deviation of the lumbar spine. Sacral misalignment occurred mainly in patients with dysplastic coxarthrosis (35 (38.8%)), combined with pelvic asymmetry, while the angle of sacral misalignment (sO) varied from 0° (no misalignment) to 10° and averaged 1.6±1.9°. The value of scoliotic deformity of the lumbosacral spine, measured by the Cobb method, ranged from 0° (no scoliosis) up to 21° (grade III scoliosis) and averaged 4.9±5.1°. Analysis of degenerative parameters showed that vertebral body osteophytes were present in 62 (68.9%) patients. In 23 cases, bone growths localized on the body of one vertebra were detected, and in 19 cases-on the body of two vertebrae. Osteophytes of three, four, and five lumbar vertebrae were found in 13, 3, and 4 patients, respectively. Bone growths of the fourth (n=42), third (n=30), and fifth (n=29) lumbar vertebrae were most common. Osteophytes of the first and second lumbar vertebrae were diagnosed only in 13 (14.4%) and 16 (17.7%) clinical cases, respectively. The study of the average values of the intervertebral disc height, their sphenoid shape, and the height of the intervertebral openings revealed a tendency to a steady increase in these parameters from the L1–L2 segment to the L4–L5 segment, followed by a sharp decrease in the L5–s1 segment. This fact, in our opinion, reflects the greatest vulnerability of this vertebral-motor segment, especially in patients with hyperlordotic posture, which occurred in 75.4% of cases. Osteoarthritis of the arch-process joints due to static overload of the posterior spine occurred in 46 patients with the third (51.2%) and 22 with the fourth (24.2%) types of lumbar lordosis (hyperlordotic posture) and mainly affected the lower lumbar segments. A comparative statistical analysis showed that the values of degenerative parameters of the vertebral-motor segments had a clear tendency to statistically significant difference (p=0.076) depending on the type of lumbar lordosis. Thus, in patients with hypolordotic sagittal vertical posture (the first type of lumbar lordosis), degenerative-dystrophic changes in the anterior spine prevailed (5 clinical observations or 5.5%). On the contrary, degenerative morphological changes of the posterior spine due to static overload occurred in the majority of patients (58 or 75.7%) with hyperlordotic vertical posture. The presence of multiple degenerative-dystrophic changes, localized mainly in the lower lumbar vertebral-motor segments and confirmed by the results of additional studies, served as the basis for the development and introduction into clinical practice of a method of targeted radiography of the spine in a standing position with a physiological load of body weight.develop a diagnostic algorithm. Discussion By now, it has become obvious that the morphological basis of coxo-vertebral syndrome, regardless of the etiology of deforming hip arthrosis, is the formation of one or another type of static deformation of the vertebral-pelvic complex (pelvic skew and scoliotic curvature of the spinal column, excessive pelvic anteversion and lumbar hyperlordosis et al.), as well as manifestations of degenerative-dystrophic changes in the lower lumbar vertebral-motor segments [1, 9, 18]. The role of spinal diseases, which were considered the leading pathogenetic link in the development of coxo-vertebral syndrome, remains controversial. A number of researchers have described the effect of changes in the vertebral-motor segments on the development of coxarthrosis [15, 16], while other authors consider only the pathology of the hip joint as the cause of hip-spine syndrome [14]. the results of our study indicate the prevalence of hip joint pathology in the structure of the disease under consideration.

Conclusions

1. Coxo-vertebral syndrome is a group of combined heterogeneous degenerative-dystrophic lesions of the hip joint and spine, which differ in etiology, clinical and radiological manifestations. The main variant of compensatory sagittal vertical vertebral-pelvic balance in patients with the considered profile is hyperlordotic, including the third (51.2%) and fourth (24.2%) types of lumbar lordosis, while the formation of the latter occurs mainly due to the lower arch of lumbar lordosis, equal to the slope of the sacrum. The main variant of frontal static deformity of the vertebral-pelvic complex is pelvic skew (58.8%), combined with the formation of a scoliotic arch (45.6%) or lateral deviation of the spine (13.3%).

2. Hyperlordotic variant of sagittal deformity позвоночноof the vertebral-pelvic complex is accompanied by the formation of degenerative-dystrophic changes, mainly in the posterior lumbar segments of the spine with the

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development of osteoarthritis дугоотростчатыхof the arcuate joints and spinal canal stenosis. The hypolordotic variant of sagittal deformity of the vertebral-pelvic complex is accompanied by degenerative changes, mainly in the anterior parts of the vertebral-motor segments.

3. The developed comprehensive diagnostic algorithm allows, based on complaints, anamnesis, clinical and neurological symptoms, laboratory data, and the results of an X-ray examination, which includes, in addition to standard methods, radiography of the vertebral-pelvic complex, supplemented by indications with radiography of the spine with a functional load of body weight, Ct, Mri, and functional RENTgen

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