ANATOMICAL AND CLINICAL OBSERVATIONS ON STRUCTURAL CHANGES OF THE HIP JOINT

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ANATOMICAL AND CLINICAL OBSERVATIONS ON STRUCTURAL CHANGES OF THE HIP JOINT (Abstract): The hip, the second largest joint of the human body, with its primary contribution to locomotion, is exposed to numerous traumatic or non-traumatic risks. Regardless of the initial pathology, there is always almost the same result: diminution of range of motion, onset of pain and functional impotence, as well as change of biomechanics of walking. Through its high frequency, morpho-functional imbalance (clinically expressed both imagistically and biologically, in one or several joints), osteoarthritis is a disease with a multifactorial etiology and a complex pathogeny.

Material and method: The study included 244 patients aged between 18-85 years, clinically and paraclinically investigated, especially for the osteoarthritis of the hip, admitted to Rheumatology Clinic I, Rehabilitation Hospital in Iasi, from January 2012 to December 2014. Results and Discussion. The high prevalence of degenerative diseases of the joints in old age is analyzed in accordance with the results of the estimations, which showed that, in fact, most of the patients remain undetected, undiagnosed and untreated. Main symptoms are pain in the coxofemoral joint, radiating or not on the lateral or anterior face of the thigh down to the knee, morning stiffness after a long rest, limping or walking with small steps, and muscle atrophy of the group of muscles that are responsible for the stability of the joint. Conclusions: A strict discipline is needed from the patient’s side, in order to keep and apply the doctor’s indications in a chronic disease that requires a long therapy, on one hand; on the other hand, a close cooperation between various experts is needed, in order to customize and apply the most effective program, at the right time. Keywords: OSTEOARTHRITIS, DEGENERATION OF CARTILAGE, BONE RECONDITIONING, FRACTURE.

The human locomotor system contains structures of the body that, through complex interactions between components and between components and the environment, generate support and movement of the body. Anatomically, a joint is a system made of passive and active components (1).

The hip joint (coxofemoral joint) is a synovial joint that connects the femur bone (femoral head) and the basin of the skeleton (acetabular cavity). It has the form of a typical spheroidal joint, a triaxial enarthrosis with a ligament transfer found at the area between the trunk and the free lower limb, with three axis of movement. When in orthostatic position and resting on both pelvic limbs, the femoral head is loaded under compression (2). As it rests on both
femoral heads, the basin needs only very small muscle forces for frontal stabilization. The body weight is directly and evenly distributed on both lower limbs. The following movements are made at the hip joint: flexion - extension, abduction - adduction and internal rotation - external rotation (3).

Friction and / or wear may occur as a result of the relative movement between the joint parts. An increase in wear or deterioration may also be due to changes in the synovial fluid or cartilage (4).

Hip osteoarthritis is joint damage caused by an interdependence between the morphological and functional imbalance. It is the most common hip disorder, a painful chronic arthropathy, a progressive and highly disabling disorder, with higher prevalence in males, that limits the static and dynamic status of a person as well as the self-care routine activities.

The common goal of all forms of treatment is to break the progressive pathogenic chain of the disease in order to create conditions for regeneration of the joints.

The purpose of this paper is to evaluate the possibilities for diagnosis and treatment, considering the fact that the radiological examination is essential during diagnosis, monitoring, progress, and the options for therapeutic indications.

We included the measured height and weight, abdominal perimeter (normal if less than 94 cm in men and 88 cm in women), calculation of body mass index, reading of blood pressure and pulse. The investigations also included EKG, paraclinical tests (level of serum glucose, cholesterol and HDL – cholesterol, triglycerides, highlighting the inflammatory syndrome – ESR and CRP). The anthropometric measurements revealed obesity in 179 cases of women (73.36%) and 51 (48.2%) cases of men.

Concerning the climatic factors, 74 (30.32%) cases complained of the aggravation of symptoms due to environmental changes. Occupational risk activities were revealed in 8.60% of patients operating with vibrating instruments or performing running or horse riding.

RESULTS
The hip pain is a chapter in pathology with great significance for medical rehabilitation, since its prevalence is higher and higher, asking for expert’s involvement in a complex and effective treatment.

MATERIAL AND METHODS
The study group was randomly chosen; the data were collected from the patient charts, and the patients were interviewed through a questionnaire.

The study was conducted on a group of 244 patients aged between 18 and 85 years, assisted in Rehabilitation Hospital in Iasi, Rheumatology Clinic I, from January 2012 to 31 December 2014. The selection of the group was based on inclusion and exclusion criteria. The method consisted of statistical analysis of results obtained by analyzing the patient charts, considering: background, age, gender, onset symptoms, risk factors, radiological manifestations, type of recommended treatment, response to therapy, treatment – induced toxicity, as well as the quality of life.

We used ANOVA test for descriptive statistical analysis (t-Student) quantitative significance to measure variability and the weight of the observations. The data base was managed in Microsoft Office Excel, while the statistical analysis was made in MedCalc and Epi Info 2000.
ty years old and in seniors, with an equal prevalence in both genders, is the main cause of disability and prosthetics in elderly (5,6,12). The patients benefit from a complex and long lasting therapeutic scheme, in two stages: a medical one, conservative, combining hygiene of the joints, drugs and maintenance or functional reeducation physical therapy, and a surgical stage (6,7).

Most often, degenerative pathology of the hip shows in 57-79 age group. The age, with morphological and functional changes it induces in this structure, has a major role in setting of the degenerative process. 187 patients (76.63%) came from urban settings and 57 patients (23.57%) from rural setting, predominantly from urban setting, with a high statistical difference (p <0.005).

The major symptom of the disease was pain, felt in the inguinal area, frequently radiating on the inner side of the thigh, more intense around the knee, on the lateral or posterior side of the lower limb, without extending the lower third; to a great extent, the pain was felt almost continuously with nocturnal recrudescence and morning stiffness.

174 (71.31%) cases were males, while 7 cases (28.69%) were females; the difference is statistically significant (p < 0.005).

There were cardiovascular comorbidities in 49 patients (20.08%), respiratory - 11 patients (4.52%), gastrointestinal - 24 patients (9.83%), osteoarticular - 51 patients (20.90%), neurological - 14 patients (5.73%) and other comorbidities - 95 (38.94 %).

In some forms of osteoarthritis, the genetic blueprint may be considered, which in our case is present in 71% of the patients, who reported a degenerative articular disease in first degree relatives.

Pathological personal antecedents of the cases are: fractures - 74 cases (30.32%), luxations - 34 cases (13.93%), meniscal injuries - 13 cases (5.34%), hemarthrosis - 17 cases (6.98%), synovitis - 21 cases (8.60%), metabolic and endocrine diseases - 18 cases (7.39%), rheumatoid arthritis - 19 cases (7.78%), neurological diseases - 9 cases (3.68%), circulatory disorders - 39 cases (15.48%) (table I).

<table>
<thead>
<tr>
<th>Antecedents</th>
<th>No.</th>
<th>%</th>
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<tbody>
<tr>
<td>Fractures</td>
<td>74</td>
<td>30.32</td>
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<tr>
<td>Circulatory disorders</td>
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<tr>
<td>Luxation</td>
<td>34</td>
<td>13.93</td>
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<td>Synovitis</td>
<td>21</td>
<td>8.60</td>
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<tr>
<td>Rheumatoid arthritis</td>
<td>19</td>
<td>7.78</td>
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<td>18</td>
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<td>Meniscal injuries</td>
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<td>Neurological diseases</td>
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As found in other authors (9,12), we discovered that fractures were the most frequently involved in etiopathology of osteoarthritis (30.32%), followed by peripheral circulation disorders (15.48%) and luxation (13.93%).

In most of the cases, the diagnosis of hip osteoarthritis is facilitated by a careful anamnesis, which points out to the onset of the pain, location, radiating pain and by the physical examination of the patient. The onset of the disease is insidious; for many patients it starts as fatigue of the coxofemoral joint after a long static or dynamic activity. Pain is the main symptom in all primary or secondary forms of disease; patients experience the symptom spontaneously and in motion, in groin, retrotro-
hanterian or gluteal area. Some patients report pain on the knee ("the cry of the hip"), or, as Lequesne notices, knee pain might be the only expression of hip involvement (5).

The pain is mechanical, the patient presenting an antalgic gait, shortening the duration of leaning against the affected part. The limping appears, caused by muscle insufficiency of the middle gluteal muscle, while in advanced phases, the patient displays an obvious vicious attitude. The most damaged muscle groups are the extensors and the abductors of the thigh due to the biomechanical changes during gait and to the decrease of their physical demands. Muscular analysis of thigh was required by major hypotonic in thigh and especially in the *gluteus medius* muscle, known as the muscle which is mostly prone to hypotrophy in case of inactivity. This results in gait waddling on one side due to the disturbance of the muscular balance of the basin, changing the parameters of gait.

Physical examination, performed in orthostatic, in static and dynamic position and in decubitus, shows at inspection, touch, percussion and examination of mobility the following: vicious position of the lower limb and trunk, amyotrophia, muscle contraction of abductor muscles, pain during direct percussion of the great trochanter, shortening of the pelvic limb, disorders of the statics of the spinal cord.

During physical examination of the hip, we noticed the predominance of objective signs that concerned synovia, in spurt flares and pain during mobilization of the joints. The walking perimeter varies a lot among patients; 132 cases (54.09%) still have a walking perimeter over 500 m.

Special tests of assessing the degree of affecting the articular mobility were made in 137 cases (56.14%). Positivity of special tests on hip mobility were: Patrick test – 59 (43.06%) cases, Trendelenburg test - 41 patients (29.92%) cases, Thomas test - 21 (15.32%) cases, Ober test - 16 (11.67%) cases (fig. 1).

![Fig. 1. Positivity of special tests on hip mobility](image1.png)

Non-specific inflammatory tests (ESR, CRP etc.) were positive in 41 (16.80%) cases.

In case of our research, similar to other authors’ research (9,11), the early diagnosis of hip osteoarthritis was made through special investigations: ultrasonography in all 244 cases, CT in 71 (29.09%) cases, IRM in 64 (26.22%) cases, arthroscopy in 29 (11.88%) cases (fig. 2).

![Fig. 2. Special tests were made in early diagnosis of hip osteoarthritis](image2.png)
IRM imagistics is better than radiography and CT when assessing cartilage integrity and cephalic contour, with indications in early stages of the disease.

Radiography is the first line examination. Anterior-posterior and lateral radiography of the basin in orthostatic position are used to exclude other causes of coxopathy and also to make a coxometric evaluation and to show the degenerative changes in the hip joint and in the proximal joints, in the lower lumbar spine and in sacroiliac joints (7).

The radiological semiology of hip osteoarthritis was characterized by the following changes in the studied cases: narrowing of the joint interline (which seems to be the most accurate assessment tool of the stages of hip osteoarthritis, showing the progressive destruction of joint cartilage) (8). Radiologic changes were present almost constantly; reduction and even disappearance of joint space - 159 (65.16%), sclerosis of subchondral bone in 48 cases (19.67%), osteophytes - 8 (3.27%), geodes - 2 (0.81%), subluxations - 12 (4.91%), erosive phenomena - 11 (4.50%), ankylosis - 4 (1.63%) cases.

In 1982, Baird et al. (see reference 9) confirmed the value of CT after hip luxation, detecting the intraarticular fractures.

Ultrasonography brings guidance, since joint is difficult to approach and it is used as a special means, “the extension of the clinic exam”, but the hip joint is deep and difficult to access.

The intensity of the primary degenerative process was: first degree - dubitable osteoarthritis, 12 (4.93%), second degree - minimal, 136 (55.73%), third degree - mild, 74 (30.32%), fourth degree - severe, 22 cases (9.02%) (fig. 3).

![Fig. 3. Evaluating the degree of the primary degenerative process](image)

Treatment: The patient usually follows two therapeutic stages. The first stage is the conservative treatment that delays the development of the disease and maintain an acceptable functional status by using a multidisciplinary approach: drug therapy, physiotherapy and orthopedic rehabilitation. In the second stage, the morphological and functional damage leads to surgery mostly in the form of joint prosthetics. At this stage, is estimated that the optimal age for prosthetic rehabilitation is after the age of 65.

Conservative treatment aims to relieve
pain, to improve the functional deficit and to slow the progression of the disease. The conservative therapeutic methods are pharmacological and non-pharmacological. Pain and inflammation were relieved with antalgic, anti-inflammatory and muscle relaxing drugs. Pharmacotherapy was used in 139 (56.96%) cases, and 74 (30.32%) subjects had a pluridisciplinary treatment.

The initial antalgic treatment included acetaminophen 0.5-1 g every 6-8 hours, without exceeding the maximum doze of 3 g per day, while AINS were used as anti-inflammatory drugs (diclofenac, piroxicam or meloxicam).

In hip osteoarthritis, the local infiltrations were avoided because corticosteroids have a transient effectiveness, increasing the degradation rate of the articular cartilage.

Electrotherapy and physical therapy were used as non-pharmacological therapy.

The pharmacological treatment was accompanied by adverse reactions, such as: gastric pain – 56 (22.95%) cases, nausea – 72 (29.50%) cases, vomiting – 12 (4.91%) cases, constipation/ diarrhea – 7 (2.86%) cases, headache, vertigo – 9 (3.68%) cases, allergic reactions – 10 (4.09%) cases, anemia/ leucopenia/ thrombocytopenia – 18 (7.37%) cases, increase of blood pressure – 13 (5.32%) cases and no side effects – 47 (19.26%) cases.

The non-pharmacological methods of rehabilitation are electrotherapy, massage, thermotherapy, hydrotherapy, balneotherapy and physiotherapy.

The rehabilitation program included electrotherapy that has an analgesic and excitomotor effect and stimulates local circulation in 15 cases (6.14%). The massage was performed in 45 patients (18.42%) through analgesic decontractive applications used to stimulate local circulation and tone the deficient muscle groups, providing a real benefit to the patient.

The design of a physical therapy program for hip rehabilitation considered that the joint provides the monopod and bipod support joint in statics and dynamics forming with the pelvis a functional unit. This is possible due to a particular architecture and to an effective muscle apparatus for achieving the pelvic-femoral balance. The physical therapy program was made according to the clinical, radiological and functional evaluation and it was adjusted depending on comorbidities.

Physical therapy was performed in 84 (34.42%) cases, involving various procedures for muscle strengthening, torn muscle relief, asuplisation of capsular ligaments, and exercises for increasing the joint amplitude.

The physiotherapy program used in the study group provided an effective relief of pain, changes of vicious attitude of flexion, adduction and external rotation, the increase of joint range of movement and muscle strength, the rehabilitation of dynamic muscle control in walking, the ability to perform certain daily activities, so that the patient’s quality of life is highly impacted.

The outcome of the rehabilitation programs, namely the improvement muscle strength in the basin area, led to a limitation of tilting movements during walking. This limitation was functionally shown by the relief of limping, even if it was not permanently removed.

The surgical path is used for inserting hip prostheses through minimally invasive methods and it has been extensively studied over the past decades. The minimally invasive methods have a less impact on the peri
Anatomical and clinical observations on structural changes of the hip joint

- and intra-articular ligamentous structures. Minimally invasive surgery is less aggressive and highly recommended in old patients with chronic diseases, as it allows a much faster functional recovery (11). Limiting surgical and anesthetic risks is very important, especially as the age of patients undergoing such interventions has continuously dropped in recent decades (12). Hip replacement or, in medical terms, total hip arthroplasty, is a successful story in orthopedics as it provides a solution for millions of people with irreparable damage of this joint.

**DISCUSSION**

The structural changes of the hip and particularly the functional changes, such as the onset of pain, muscle contractures and / or retractions contribute to the limitation in the mobility of the coxofemoral joint.

In the study group, the onset of pain in the affected hip led to the development of poor habits and bad static and dynamic postures. Body weight was automatically distributed on the healthy lower limb and the healthy joint was overloaded. This habit represents a bad motor engram that changes the normal gait. The gait becomes limping and support appears and a change in step times. The deviation of the center of gravity to the front is significantly higher in patients experiencing pain in the coxofemoral joint than in patients free of these disorders.

A rigorous and comprehensive biomechanical analysis of the hip joint can provide important additional information for the complex preoperative assessment, leading to a future therapeutic approach.

The study group consisted of 244 patients, most of them aged over 65 years, mostly originating from urban settings (76.63%). During physical examination of the hip, there were objective signs that concerned the synovial part and mobility pain.

*Wright* (11) describes a syndrome that destroys the femoral nucleus, related to poor blood supply of the upper femoral epiphysis. *Jacques Calve* (12) published in "Surgery Journal" a monography, entitled "On a particular form of pseudo-coxalgia associated with a characteristic deformity of the upper end of the femur". The author describes the disease clinically and radiologically, excluding the traumatic and infectious etiology.

The importance of the hip "discharge" increased gradually due to research conducted by *Waldenstrom* and *Danforth* (12). *Catterall*’s radiological research is remarkable (17). The external epiphyseal fracture was described by Fergusson, consisting of separation of an external fragment from the epiphyseal nucleus, a consequence of the external epiphyseal surplus (19).

*Lawrence* (11) showed that in subjects between 15-24 years old, the degenerative lesions pointed out by X-rays are present in 10% of the cases, compared to 80% in age groups over 55 years.

Compared to our study, the regularity of the femoral head is appreciated radiologically by concentric circles, placed at 2 mm distance, conceived by *Mose* (11); articular surface index, first used by *Meyer*, offers information about the morphology of the head; it is the ratio between the height of the head and its diameter (18).

*Trueta* (9) believes that osteoarthritis is secondary to high blood pressure in the hip joint, influencing this way the nutrition of the cartilage. Intraarticular forces will cause loss of elasticity connective tissue,
degenerative and necrotic phenomena in the areas where they act.

De Sèze and Duriève (12) believe that some vascular processes that influence the trophicity and metabolism of joint structures may cause hip osteoarthritis. Rutishauser et al. suggest that venous stasis has an important role in the development of osteoarthritis.

Axaser suggests that the chondrolysis process can occur due to damaged blood circulation in the subchondral area (9). Pommer and Lang show that this disease is the result of a dynamic imbalance between cartilage resistance and loading forces. This leads to severe changes in the physiological properties of the cartilage. This mechanical functional theory explains the presence of marginal osteophytes, bone products caused by improper mechanics (11).

Trueta explains the predominance of the fractures in 56 male patients (22.95%) (14) by traumatic factors that act in this period. Chung (11) explains this predominance in males by a particular vascular structure, unproven, but experimental.

Worldwide, osteoarthritis is the most frequent muscular-skeletal disease, affecting population over 55 years of age Hinman, Hezwood (11), while future forecasts predict a significant increase of incidence and severity, with particular implications for the health of the population.

The mechanical theory of Freeman (12) attributes the degenerative process to fracturing of collagen fibers.

Ficat (11) divides the disease into mechanical, structural, inflammatory and infectious chondroses, according to the condition and etiology of the destructive processes.

CONCLUSIONS

Our observations revealed the high frequency of fractures – 74 (30.32%) cases after 60 years of age, proving the fact that degenerative osteopathy is an old age disease; most of the subjects came from urban settings – 187 (76.63%) cases, with an easier access to health care services.

At study enrollment there were the following comorbidities: 49 (20.8%), respiratory -11(4.52%), gastrointestinal - 24 (9.83%), osteoarticular - 51(20.90%), neurological - 14 (5.73%), other - 95(38, 94%) cases.

We were able to identify at least one risk factor that could be incriminated in the etiology of the degenerative disease in all patients: fractures -74 (30.32%), luxations - 34 (13.93%), meniscal lesions -13 (5.34%), hemarthrosis – 17 (6.98%), synovitis – 21 (8.60%), endocrine and metabolic disease – 18 (7.39%), rheumatoid arthritis - 19 (7.78%), neurologic diseases - 9 (3.68%), circulatory disorders - 39 (15.48%) cases.

As for radiological investigation, we concluded that it has an important role, facilitating the diagnosis, without being indispensable.

Although not lacking side effects, the pharmacological treatment contributed to pain relief in patients with degenerative hip pathology who face an important degree of disability (pain, vicious position, walking perimeter). The rehabilitation of joint mobility must be associated with the rehabilitation of strength in muscles that perform these movements.

It became obvious the fact that a therapeutic, educational, medicinal and physical combination is able to control the patients’ sufferance from the onset of the disease, in an effective patient-physician cooperation.
REFERENCES