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Review Article

ARTHROSIS - MODERN DISABLING DISEASE. OPINIONS ABOUT RECONSTRUCTIVE SURGERY IN PELVIC LIMB ARTHROSIS

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Abstract

The authors of this article express their views relative to the surgical treatment of main joints of the pelvic limb, affected by arthrosis, pathological entity feature our current epoch.

It advocates for devoting more attention to certain treatments to help the biological mechanisms of reconstruction and remodeling of these joints, considering the current evolution of the knowledges and researches in this area.

In this sense, it is also mentioned our personal experience gained over the last two decades.

Keywords: *arthrosis, surgical treatment, „biological surgery"*

Rezumat

Autorii acestui articol analizează opiniile referitoare la tratamentul chirurgical al unor segmente ale pelvisului afectate de artroză şi aspectele patologice din contemporaneitate.

Se acordă o atenție deosebită mecanismelor biologice de reconstrucție şi remodelare ale acestor leziuni, după evoluția curentă şi cercetările din domeniu.

În acest sens, este menționată şi experiența noastră din ultimele două decade.

Cuvinte-cheie: *artroză, tratament chirurgical, „chirurgie biologică"*

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I. Introduction

The bone, anisotropic material with variable resistance to traction, compression or torsion and special elasticity in its different spatial structures of the skeleton content (viscoelasticity) has special features on adjacent portions of the bearing surfaces of pelvic limb joints.

The bone's cellularity and biochemistry, in light of recent research, constitute dynamic factors with a biological potential more important than we imagined years ago, what we require in a modern attitude, constructive, in the therapy of some diseases. Current gains in the field of transplants, grafts, stem cells, growth factors, etc. strengthen our option for a "biological" surgery, to help and stimulate the natural processes of morphofunctional restructuring. Renato Bombelli, one of the promoters of this new mentality, strongly promoted what he called "ecosurgery".

The idea for this "biological" surgery is older, it gave ground in the last 3-4 decades to the replacement surgery (endoprosthesis, allogenic implants, etc.), area where great progress has been made (quality and composition of the implants, their tolerability - implantation techniques, morpho-functional "engineering" of endoprosthesis), but that even today raise serious questions about their evolution (infections, soft tissues destructions, periprosthetic osteolysis and osteoporosis, unforeseen and still unexplained chemical reactions, etc.).

Away from us the idea to minimize the enormous progress made by the prosthetic replacement surgery, but as old followers of the "biosurgery" (ecosurgery), we can't to notice the interest and a growing research activity in recent years, for reconsideration of the biological potential in the reconstruction of the locomotor braditrofic structures (bone, cartilage, capsulo-ligamentar apparatus), potential that any surgeon can capitalize and help.

The main joints of pelvic limb (inferior), whose pathology is dominated by osteoarthrosis diseases (degenerative), and Imec Standing, mechanical stresses of modernity (walking, transportation, professions, lifestyle and nutrition, etc.), genetic changes of various reasons, certain geo-ethnic features ("Caucasians" are making less often idiopathic arthrosis, the peoples of the extreme East Asia's very rarely suffer from coxarthrosis), the action of modified environmental factors to the genetic equipment, etc. - lead to multiple morphofunctional changes in various structures, the joints being among the most affected.

The osteogenesis, bone remodeling, adaptability "on the fly" (very small) of the articular cartilage are making these degenerative diseases true reasons of invalidity (R. Duthrie shows that in Great Britain, in the '90s, there were 37 million days of leave - 11.6% of working time - for these conditions.

II. Etiopathogenic and pathophysiology data

It is appropriate to clarify some remarks about the determinant causes and mechanisms in the emergence and evolution of the arthrosis of inferior limbs.

Against the backdrop of some favorable cases and, definitely, conducive to the emergence and degradation of the arthrosis, such as:

- occupational (overload, vibrations, prolonged joint compression, over-bearing surfaces, etc.);
- traumatic (10-20%), wich change the normal position of joint components or affect vascularization;
- congenital deformity (3-15%) or acquired during the life, or as a consequence of some endocrine or metabolic diseases, or, finally, iatrogenic (6-9%);
- diseases of synovial membrane, capsulo-ligamentar apparatus;
- congenital diseases (Marfan, Morquio, Charcot, Hurler, etc.) are installed, with the time, through complex disorders of the local biology, the **arthrosis**. (1)

As is known (in practice and in literature), not always favorable or determined cases can be detected and then we have to tabulate these arthrosis such as **idiopathic** or **primitive** osteoarthritis (80-87% of cases).

"Idiopathic" necrosis may be difficult to prosecute a case. The only item that is precisely in this type of disease is the bilateral appearance of the lesion, from the beginning. In history we can detect, a lot of possible causes suspected as favorable, but never scientifically confirmed: (2, 3, 4, 5, 6, 7, 8, 9): repeated trauma, local inflammation, alcohol consumption, smoking, activities in environments with variations in pressure, specific immune activity (Milgrom noted a higher NACF incidence in pacients with renal transplant.

In our service we have noted significantly higher incidence of bilateral NACF (oligosimptomatic initially) in patients with urinary stones, asthma, long term treatments with immunosuppressive agents, antimalarials, corticosteroids. Note that the pain, in many of these patients, occur very late (III^{rd} - IV^{th} stages - Ficat-Arlet);

Vibrations also could cause necrosis of the femoral head (banks for heavy equipment, miners who work with pneumatic tools, etc.);

In recent years, in our service, we recorded a significant number of younger patients (men, 28-34 years) with this disease and working as TIR or heavy transport professional drivers. Secondary NACF are no longer to discuss, being known (LES, idiopathic coxarthrosis, DLS, sequelae of Legg-Calve-Perthes disease, etc.).

The mechanisms that could lead to morphological disturbances were systematized in the last years, by eliminating the theoretical assumptions (18, 19, 20).

Today, the major pathophysiological implications of their changing are recognized as following:

- purely mechanical mechanisms that determine intramedullary microbleedings (Hunger ford);
- variations in blood pressure into the greater trochanter, neck, and then femoral head (scientific research with Technetium-99 - Miki, Orloff, Pasteels, Hauzer) but the practical demonstration, in experimental models, is insignificant;
- autoradiography with radionuclides in various forms of NACF gave no conclusive results;
- subchondral vascular pathological changes, caused by the synovial and capsular congestion with criptogenetical origin could be a cause of local venous stasis. Variations of blood flow (ONO, Inquire, Saito, Warner, Swiontkowski) are

experimentally highlighted but may not be still given another pathognomonical explanation;

- Basset, Takatoril, Hauzer seek to detect by MRI local ischemia stages but it seems that they are not in accordance with the radiological evolutionary phases (Ficat-Arlet classification); in any case, this paraclinical exploration may be a preference factor.

The complex laboratory explorations appears in the latest decades follow the evolutionary progress of the condition in the hypothesis that it may help determine therapeutic indications - Robinson (MRI), Stulberg (MRI), which is associated routine radiological examinations and puncture-biopsy have shown the fibrovasculary invasion under the area of necrosis, but its extension is not explaining the radiological staging - almost universally accepted - and not also the clinic one (different scores). One problem not still elucidated is the role of the alternations of levers and open and closed kinematic chains during the activity of the pelvic limbs, in arthrosis evolution. It seems highly freedom joints and musculo-tendon conduction (hip enarthrosis) evolves over time and less dramatic than the joints with "restraint" (condilary joint of the femur, with bone and ligament conduction).

In an arthritis, all structures are suffering (epiphyseal bone, subchondral bone, cartilage, synovial membrane, synovial fluid rheology). The capsule-ligamentar elements are suffering from fibrosis, wich generates the articular instability, aggravating the disease. The atrophy, "drying" of the articular cartilage, the changed synovial fluid biochemistry are leading to a local "stress", with response until epiphyseal articular depth (sensitive inervation, vegetative plex, vascular plex), pathophysiological aspect quite neglected before.

The clinical and laboratory explorations, and the history too must take into account all the above in order to therapeutic sanction which, in our opinion, should be centered on a "biological" solution, that then can be filled with other solutions. Judging the surgery indication should not make abstraction of an essential element which influences prognosis and evolution of surgery: assessment of current status of walking mechanisms (including internal and external forces):

- the functioning of nerve impulses (round trip),
- the qualification of muscle contraction, adjacent to the joint,
- the quality of movement and power levers, active and passive mobility of joints.

III. Specific aspects of the pathophysiology of pelvic limb arthrosis

It is useful to emphasize some objective findings result from clinical experience and research of well-known colleagues from Romania and abroad, and from our experience too, in the last 10-15 years, which motivates our interest and defense for granting of credit increased to the "biological"surgical therapy in osteoarthritis.

After Rutishauser, Lagier, Mankin, Lipiello, Mitchell, Goutallier, etc., all the active and passive elements of knee joint suffer, in different phases, changes that causes dysfunction and then morphological degradation of the joint. Dutkowsky think that

around the age of 35 years, especially women, suffer a *"poliarticular degenerative arthritis"*, of unknown causes (recently has been incriminated the imbalance androgen/estrogen) that restricts gradually to a *"monoarticular arthritis"* (the knee more often than the hip). Leach, Bloom, Lindblad, Hedfors, Jarunen, Yasuda are just some names of researchers who were involved in deciphering the causes of these "primary" injuries. The newest research consider that the entire joint biological imbalance is generated by the initial morphofunctional changes of the due muscular-tendinous apparatus and of the neuromuscular complex serving for articulation, while rheumatologists (F. Liote, P. Hasselbacker, C. Codreanu, St. Suteanu) emphasize the role of the microcristaline inflammation in triggering the synovitis, with adverse consequences for cartilage (degeneration) and for the synovial fluid (alteration of the composition). The incriminated crystals are monosodium urate, calcium pirophosphate, calcium phosphate, that trigger inflammatory events under the mediation action of some kinine and lysosomal protease, leading to activation of synovial neutrophils with the consequence, arthritis. The repeated crisis of this type of arthritis leads to arthrosis. It is worth mentioning that this mechanism is typical for the gouty arthritis, but its "draft" stands valid, it seems at least partly, for arthrosis considered "idiopathic" too.

The cycle in both directions (cartilaginous degeneration ↔ synovitis reaction), with its consequences, which for some authors can also be initial factors (neuro-muscular-tendinous and vascular changes) was proved experimentally too and it is materialised by some early clinical findings:

- tendinous-muscular changes (decreased elasticity of the tendon and muscle force, change of the local blood supply);
- bioelectrical changes of neuro-muscular-tendon;
- neurovascular insufficiency (periarticular, muscular-tendinous).

As to the behavior of joint elements, the findings reveal:

- the number and quality of the chondrocytes are altered;
- increase of the proteoglicans, leading to proliferation of the anhist gel (matrix), which then decreases if the stimulus for regeneration with cell starting point missing;
- these decreases (cells + matrix) determine a weak re-synthesis, with consequences on the elasticity of cartilage and sclerosis row (look dull, dry, yellow, with gradual erosions). The agrecan, studied more recently, seems not to have a role in this phase, while the cytokines, known as incentives of regeneration, begin to have an anarchy activity, which affects subchondral blood circulation. The consequences are not only synovial, capsuloligamentar and cartilaginous, but also bone (the change of the local architecture by disharmonious osteonic resorption-remodeling activity).

In the early stages of imbalance resorption - remodeling can detect even an activation of blood circulation (especially in the erosion or denudation of the articular cartilage), with repair purposes, but newly formed cartilage is type hialin, with chaotic architecture, less resistant, as a consequence of the venous stasis which determine a decrease of local ph and the accumulation of intermediate metabolites. Morphological cartilage alterations make that the synovial fluid and the synovial cellularity become "aggressive" and favors more profound the muscle dysfunction, affecting the epiphyseal

bone architecture (cysts, bone spans strength altered, anarchic bone condensations, morphofunctional disharmony of the active periarticular structures). In finally, all these perverted mechanisms are enhancing and can no longer be therapeutically contested only very difficult. That,s why it appears increasingly obvious the need for deeper study and research of biology of the arthrosis, to can intervene with the "ecological" therapy in all phases, with purpose of stopping its evolution and stimulating the natural reparative processes. (21, 22, 23, 24, 27, 28, 30, 31)

Connected with the issues raised above is the target of the biological surgical therapy for wich plead:

- the restoration of normal resistance structures (see "the gothic arch" of R. Bombelli);
- the adjustment of the new static structures of resistance to the dynamic requests (muscular-tendinous) and static requests (capsulo-ligamentar apparatus, reconstruction of kinematic chains, re-evaluation of the levers, etc.) by osteotomy, spongioclasia, instillations type osteoprogenitor-STEM;
- the abolition or reduction of pain by restructuring the inervation and vasculature of the region (osteotomy, spongioclasia, pediculate musculoskeletal or muscle grafts, "enhanced" grafts);
- the bone and cartilage remodeling type enchondral, following the finding that in autologous bone pressing sites (spongioclasia) the introduction of osteostimulant preparations (aspirated bone marrow, osteoformating cells from cultures - STEM type, various stimulant pharmacological substances), causes a reconstruction of the epiphyseal area, including all its structures.

IV. Surgery of HIP and KNEE arthrosis

Summary, the purpose of surgical treatment of this diseases is:

- reduction or abolition of pain;
- stopping the evolution of the disease;
- restoring the anatomy and functionality of the region;
- restructuring the biology of the joint;
- replacement (implant) of the joint, when the above goals can’t be achieved by other processes.

From the beginning we think that some therapeutic procedures could be discussed only as means of adjuvants, although some practitioners still give them an undue credit (manipulations under anesthesia, postures, electroacupuncture, spa-reflexo-therapy), leaving to the patient the variant of disease Ds evolution till the joint destruction, only in this situation indicating the articular prosthesis (13).

In recent years is given an increased attention to the research of the evolution of articular cartilage of the bearing joints, this one still presenting enough unknown in terms of morphophysiology, cell biology and morphopathology. Its "classical" functions (elasticity, nutrition pump, protection of the epiphyseal structures), once affected, lead to its degradation, each stage of this degradation being susceptible to interventions for its correction (Koopmann):

1. Stage of chondromucoid focal degeneration - with turgid and growth of the proteoglicans from fundamental substance, followed by a defect in their aggregation and changes in the cytokines, interleukins and TNFa (necrotic "tumoral" factor), is characterised by the tendency to activate the redress mechanisms. It is the ideal stage to intervene in intra-articular with lavages, shaving, instillations of cartilage regenerating factors (glucosamines, chondroitinsulphates, etc.).

2. In the second stage decrease the proteoglicans, the cartilage is "drying", is necrotic, is "detaching" from the bone and so appear the ulcerations; the perturbation of glycoproteins metabolism is obviously. The operations for axis joint recovery and for stimulate the epiphyseal joint biotroficity now find their indication. (29)

3. The subchondral bone, which is not defended by a normal cartilage against the requests, condenses, increases its strength and mass, what leads to vascular and synovial disorders that can cause with the time, the necrosis. The operations to recovery the mechanical and static structures, and to help the autorepair mechanisms too, may still be useful.

4. The chaotic activity from the joint is reflecting periarticular too, in the panus, which in turn is malfunctioning, causing the appearance of bone spurs, of the complex deformities and of "perverted" repair trends, such as fibrosis of cartilaginous ulcerations, of subchondral bone cysts, chondroblastic anarchy with damage of the synovial membrane, etc.

5. The last phase is characterised by an anarchist remodeling (reshuffle) of string type joint (fibrocartilage, retraction fibrosis of the capsule, reactive hyperplasia of the synovial membrane with low secretory properties) is disabling and determine the decision of prosthetic substitution.

The surgery techniques in knee and hip arthrosis are multiple, but they follow, essentially, the following objectives:

1. restoring the active and passive mechanical conditions of the joint activity (axles, bearing, subchondral bone strength elements);

2. providing the opportunities for the natural recovery of support osteochondral complex with beneficial response in articular and peri-articular structures (synovial membrane, meniscus, acetabular labrum, capsular-ligamentar-tendinous apparatus);

3. in cases of irreversible dysfunctions, ensuring the joint functioning conditions as close to normal (the endoprosthesis or articular transplants - still in experimental stage).

The indications in various forms and stages of evolution of hip and knee arthrosis can be summarised as follows:

1. The drillings (Pride, Cretiu, Demarchi, Soeur, Venable, Pallazzi, etc.) classical or by arthroscopy are having trophic role, regenerative, anthological (by venous deplete of the region).

2. The drillings with addins hone graft, free or pediculate (Judet) and muscle pediculate from the glutaeus maximus muscle (for femoral head) or sartorius, gastrocnemian (for knee). (43, 45)

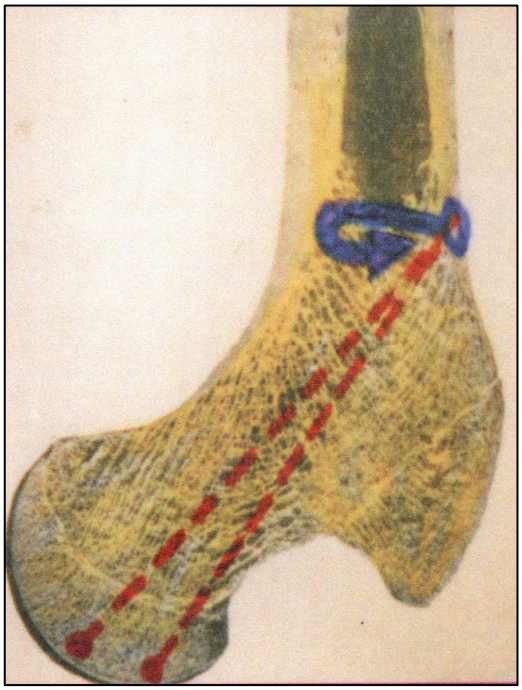
3. The patellectomy in patellofemoral arthrosis.

4. The arthroscopic interventions (lavage, shaving, emondage, chondro-epiphyseal drilling, mosaicplasty).

5. The osteotomies for medial translation and reorientation of the femoral head (hip arthrosis) or recovery of the axis (knee arthrosis) in order to restore the anatomy of the region and combat the pain through venous drainage, muscle forces change direction, change of the bearing surfaces, etc.; Nissen, Nicoll, Mc. Murray, Coventry, R. Judet, Fergusoon, Socetti, Sugiyoka, Pauwels, Bombelli, Blonut, Maquet, are only a few names of specialists who have studied and developed these surgical procedures. (26, 41, 42)

6. The artrodesis, rarely used today, with indication increasingly migrating toward the subjective options of patients or of necessity (infections).

7. The arthroplasty, which has evolved enormous in the last 30 years, using today a variety of sophisticated endoprosthesis, cemented or uncemented, with results and durability (reliability) of more and more encouraging (BHR being one of the most interesting achievements in the field of endoprosthesis, being intuited with over 40 years ago by R. and J. Judet).



8. The distance osteotomies and musculoskeletal corrections of hip or knee, when the diseases negatively influence the evolution of these joints arthrosis (scoliosis, pelvic asymmetries, inequality of the lower limbs, congenital or acquired disorders of different parts of the pelvic limb), various anchyloses, vicious side position secondary to the evolution of R.C.I, (chronic inflammatory rheumatism) - are necessary before any intervention on the hip and knee joints (Aglietti, Goutallier, Lenoble, etc.)

9. The "biological" interventions (osteoarticular echosurgery) (14, 15, 17, 25) *(figure no.1).*

Figure no.1: *Spongioclasia and drillings for instillation into the proximal extremity of the femur area.*

V. Opinions on a„biological surgery"

We will try, finally, to expose our opinion about the need for reevaluation and improvement of treatment methods in arthrosis, wich follow the use and stimulation of natural (biological) osteocartilaginous reconstruction factors in the large joints of pelvic member. To date, these methods are little used, require longer time tracking and monitoring, but recent research of the articular biomechanics and in terms of the bone and cartilage growth factors give us hope for the future of these arthrosis. (3, 4, 7, 39, 43)

Of course we do not claim exhaustion of all arguments for a method or another, but we believe that we adhere to current trends and possibilities for recovery the natural means of morphofunctional reconstruction and reshuffling of some so pretentious structures, such as load-bearing joints.

The recovery in morphofunctional conditions of a complex joint (knee, hip), helped by a well managed biological stimulation (growth factors, osteoinductive means, cells or stem cell cultures, etc.) we believe that is a future option in the surgery of these joints. The osteoinduction is today better understood and judiciously used, the autologous biological materials (spongy bone, aspirated bone marrow, cell culture on medium of choice) and also monitoring of some normal physiological processes (clot lysis, generating osteostimulating cytokines, as our research) providing us sufficient reasons for skepticism reguarding arthrosis treatment. (10, 11, 12)

Advocates of this view are, among others, R. Bombelli, Rh. Chiron, and in Romania, N. Ghergulescu, S. Diaconescu, C. Zaharia. (44, 45, 46, 49)

On the basis of the procedures we recommend and use stays the knowledge of intimate bone remodeling processes, that can be induced and stimulated. The osteoinduction, confirmed in laboratory on cell cultures obtained on certain medium extensively studied by the emergence of certain "markers" (osteocalcine, alkaline phosphatase, osteopectine, etc.) in case of STEM cell type transformation in fibroblasts capable of phosphocalcic deposits, is today used and directed in different situations. It involves:

- selection of cells from certain regions, able to transform themselves into osteoformative cells;
- stimulation or the addition of osteoinductive factors.

In the above it add the neuro-vascular-humoral adjustment of the osteoblast-osteoclast balance activity (still under study), the proteoglicans synthesis initiation factors, specific, and also humoral factors (cytokines) released during the clot lysis process, which, well directed, help enormously in the bone remodeling process.

The main surgical methods in the "biological" surgery of hip and knee arthrosis which pledge may be a win for patients and physicians, improving or solving in a big part the pain and functional discomfort on a long or even very long period of time (we can not, after 15-20 years of experience, to say "finally"). (5, 16)

A. Mosaicplasty, used almost only in knee surgery is intended, as is known, the replacement of the damaged cartilage of the articular surfaces, with osteocartilaginous plugs or pills from the neighbor non-weight-bearing surfaces (Outerbridge III and IV,

etc.). It has a relatively low value on time, if not related to or preceded by corrections of the joint anatomy (osteotomies, grafts). Computer assisted articular surgery is a modern option for this delicate operation. (3, 6)

B. Osteotomy for medial translation and reorientation of the femoral head (followed or not by drilling and instillation of osteoinductive preparation into the femoral head) is a technique long used by us with encouraging results and has as motivation:

1. keeping the morpho-functional joint structures with their own proprioceptive inervation is extremely important for modulation of the hip-joint loading in all deployment phases of closed or open kinematic chains during the activity of the pelvic limb (walk, run, jump, monopodal support outside walking, rest in upright, various items of the trunk during orthostatic activities, balance, etc.).

2. storage and recovery of still healthy joint structures - which released in new static-dynamic conditions of work, can maintain and improve their trophic qualities with admitted multiple and varied potential in case of the tissues derived from mesenchym-mesoderm; this troficity is seriously affected by the massive alloplastic implant and by the cement whose composition and polymerisation temperature are not safe at all concerning the local living tissues (and so braditrofic). All those who has an experience in hip surgery remember the layout and structure of the acetabulum, femur and neighbor tissues in difficult moments of revision for degraded or failed arthroplasty.

- the osteotomies of different types have in common some elements:
  → place to perform - intertrochanteric or trochanteric region;
  → purpose - reduction of the pressure into necrosis area;
  → protecting the vasculature of the femoral head.

Starting with simple intracapsular medial translation osteotomies (Fergusson) and ending with the derotation ones (Sugioka - 1978,1982, Katsuki, Hotokebuchi - 1982, Masuda, Saito, Kotz) they were a precious therapeutical alternative in NACF, with results often pretty good *(figure no.2).*

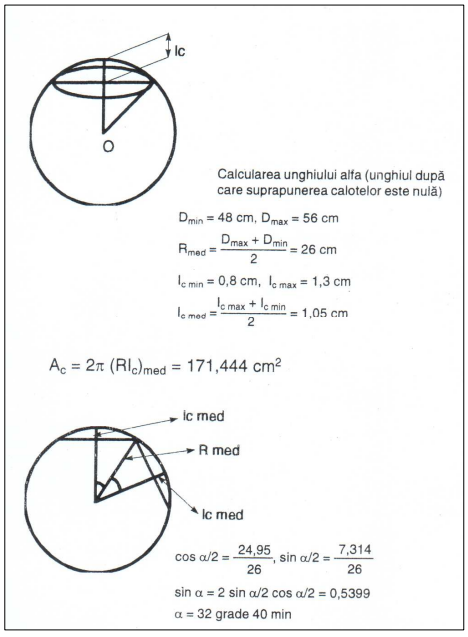


Figure no. 2: *Mathematical (spatial geometric) demonstration of the value of necrosis area translation.*

Our osteotomy for reorientation of the femoral head was not and is not presented as a treatment of choice, but as an applicable alternative to evolutionary stages 1-3 Ficat (or even 4, when the situation is stationary for a long time and the movements of the hip are acceptable). Of course, our desire to keep in this way the neurovascular structures of the joint with trophic and functional role (support, walk, orientation of the member) have to match to the evolutionary stage of the lesion, to the rate of disease evolution, to the age, profession and patient consent. Not return to the arguments presented on other occasions and that help keep the top place in our arsenal by the intertrochanteric osteotomy for reorientation of the femoral head. We believe, however, that should be taken advantage of its big possibilities for regeneration, evidenced by a series of studies rather long and laborious and supported by many good and very good results after many years of intervention. Comparing Sugioka's osteotomy and other derotation osteotomies, the osteotomy used by us respect totally the articular capsule and ensure the change of the femoral head position in three planes, releasing the maximum request area.

This weight-bearing area suffers morphological changes due to abnormal mechanical stress (probably incongruent and changes of the elasticity of the fibrocartilage on the "facies lunata" of the acetabulum), but it is not, as we said, a proper necrosis *(figure no.3).*

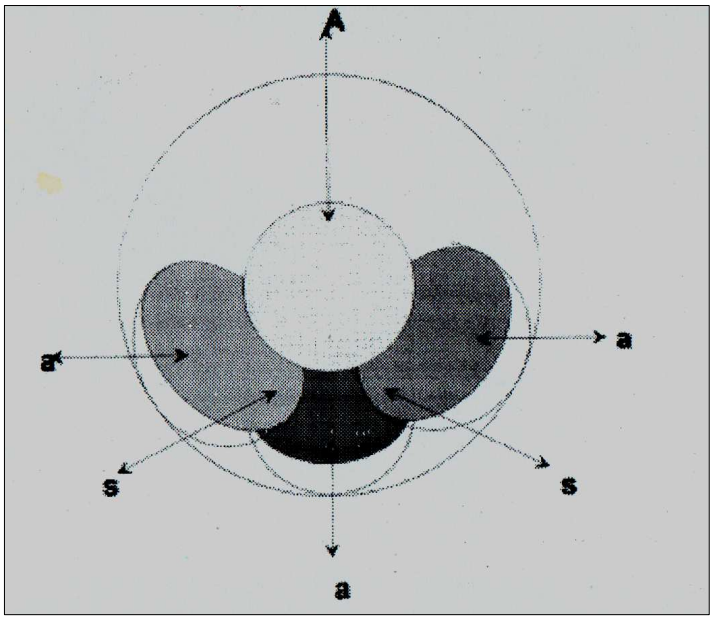


Figure no 3: *Schematic diagram of the femoral head necrosis area*
(A = necrosis area, a = the three areas of necrosis displacement through the three spatial maneuvers; s = new position of the femoral head corresponding to the interspersing areas).

Here are some reasons why we have not given up any moment to the alternative of intertrochanteric osteotomy for reorientation of the femoral head, in certain cases of aseptic necrosis of femoral head (NACF) idiopathic or secondary. This reconstructive-conservative intervention has always been improved and followed (some cases dating back over 20 years), the obtained results being encouraging in terms of functional.

We are trying for several years, a revaluation of the process as a therapeutic alternative in cases of NACF with no intention to deny the value of total prosthesis, but

pleading for the extension of indications area for the osteotomy for reorientation of the femoral head, a "biological" surgery, conserving the original morpho-functional structures *(figure no.4).*

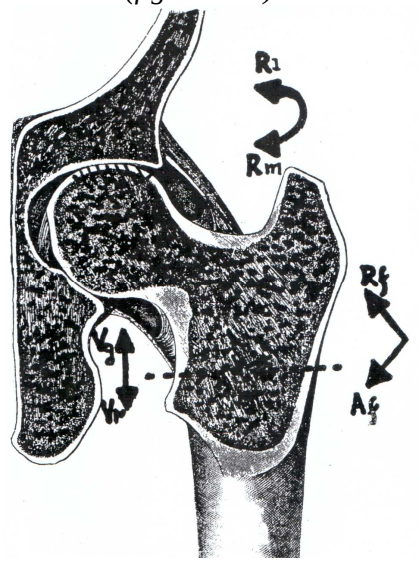
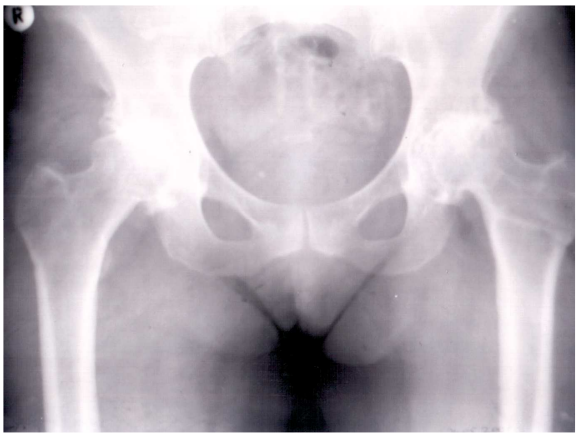


Figure no.4. *Sketch of the three diversion maneuver of the femoral head (Vg - Vr = valgus, varus; At, Af = anterior-flexion, retro-flexion; Ri - Rm = medial or lateral rotation).*

In all phases, the destruction and reconstruction processes, followed by three-dimensional specific shift, suggests a tendency for regeneration of the area permanently. The processes are concurrent, co-exist (with predominance of one or another) and creates the image of effort to adapt to the new conditions of the suffering the femoral head area. These observations prompted us to revalue the possibility of a conservative surgery (in some cases) with which we worth:

- the autoregeration ability of capillary zone related;
- the development of new mechanical working conditions of the femoral head;
- the trophic potential local neurovascular by preserving its integrity *(figure no 5a, 5b).*



5a

5b

Figure no 5 (a, b): *Right hip arthrosis (stage 3) before **(a)** and 8 months after the osteotomy for medial translation and reorientation of the femoral head, accompanied by the drilling of the head and instillation of STEM cells and osteoinductive factors **(b).***

Regardless of the scores used to assess the results, being pragmatic, in the end we are interested in pain improvement (first!) and in joint mobility. Quite a few are the patients who complain, years after the intervention, of a moderate claudication or the use of a stick (more for their comfort). From the results assessment scores we can often excludes the "radiographic" appearance that shows disastrous or unchanged pictures compared with the preoperative ones, but the subjective results (pain, mobility) are good and durable *(figure no.6a, 6b).*

Figure no.**6a**

Figure no.**6b**

Figure no.6 (a, b): *the same case (MRI) before **(a)** and after surgery **(b).***

Making the practice of surgery includes the following phases:

- placing the patient in lie flat dorsal on the table of orthopedic surgery;
- positioning the member (if allowed movements in hip joint; if the joint movements are reduced, this positioning can be done after osteotomy in the three plans);
- Harris or Gibson way to approach;
- plane transverse intertrochanteric osteotomy for medial translation (25-30% of the diameter of the femur).

Reorientation of the femoral head:

1. in the frontal plane:
- for valgus osteotomy: abduction of the member;
- for varus osteotomy: adduction of the member.

2. in the transverse plane:
- for anteflexion of the femoral head: internal angulation of the osteotomy outbreak (cushion under the knee);
- for retroflexion of the femoral head: descent of the member below the hip level.

3. in the sagittal plane:
- for anteversion of the femoral head: medial rotation of the pelvic member;
- for retroversion of the femoral head: lateral rotation of the lower

The values of changed angles of the femoral head position are within the range 5°-10° for each plan of correction. This new orientation of the femoral head should be

obtained through the movements described above, but which do not exceed 5°-10° for each of them; achieving 10° of translations in the three planes lead to a clearance of about 33% of the necrosis area and implicitly to bringing in the support area of a healthy surface, identical in size. As an important observation is worth mentioning that, where possible, the valgus and anteflexion is better not exceed 7°, otherwise there is danger of ilio-femoral ligament tension when resuming normal position of the member, tensioning sometimes painful and generator of limitation in hip extension.

The postoperative treatment is no different from that of osteotomies for medial translation, with note that partial and then all support would resume later (60, and 140-150 days) to allow the reshuffling of the head and the "revascularisation" of the joint structures. Also, after ablation of osteosynthesis material, is recommended, with good results, deep diathermy and ultrasound with hydrocortisone in repeated courses (3/year, for 3-5 years) and sea cure. It worth mentioned that along with the ablation of metallic material we practice, usually, 4-6 drillings **Φ** 4mm 3-5mm distal from the osteotomy line until the base or mid-cervical zone (no more, to not affect the capital flow). In the event of persistent pain, can add a total or territorial hip denervation, with good results and possibly a "spongioclasia" with instillation of osteoprogenitor mixture *(figure no.7a, 7b).*

Figure no.**7a**

Figure no.**7b**

Figure no. 7 (a, b): *drilling with instillation of osteoprogenitor preparation and spongioclasia, in a case of left NACF (**a** = initial; **b** = 6 months after); is observed the femoral head reshuffle [RMN]*

C. Osteotomies in knee arthrosis have indisputable indications of which the main is the axial recentering in all three plans. As a novelty, for the valgus of proximal tibia metaphysics and maintaining position, we used also a specially prepared pork bone heterograft - that keeping very good the initial reduction of varus with an additional 3°-5°, 1 recommended by Goutallier and Paillard and integrating perfect *(figure no.7c).* ⟹

D. Spongioclasia and instillation of osteoinductive preparation, we used it with nexpectedly good results, especially in treating osteoarthritis pain, but with obvious effects in troficity and remodeling of the architecture of spans bone in affected epiphyseal joints (47, 48). Our personal casuistry includes a number of 216 knee arthrosis operated by this technique, followed between 2 and 8 years. Overall findings are discussed especially in light of the results of this noninvasive process used by us, behind where we observed encouraging positive evolutions, long-term ("subcortical spongioclasia"). Starting from these findings in case of painful knee arthrosis, we extended the method into hip arthrosis, finally presenting some conclusions which plead for the use of this therapeutic process. Is also presented too the evolution of the 63 hip arthrosis or NACF operated and followed for 2-8 years *(figure no.8a, 8b, 8c).*

Figure no.**8a**

Figure no.**8b**

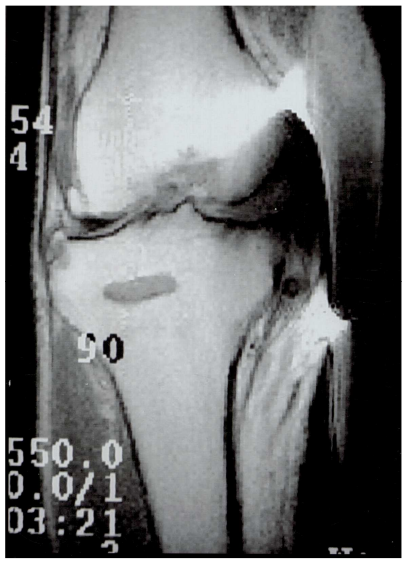


Figure no.**8c**

Figure no.8 (a, b, c): *right knee arthrosis IIIrd stage, painful, before **(a)** and 100 days after spongioclasia and instillation of STEM preparation; **c** = MRI image 100 days after.*

The random element of the technique and study of its effects is the bone drilling, whose favorable results in some periods of time were known and that we have extended to this form of osteotomy (venous drainage, metaphyseal-epiphyseal zone decongestion, stimulation of the osteo-articular regional troficity, etc. but, in particular, of the architectural remodeling of the area according to the new biomechanical conditions - genu varum, genu flexum; the new architecture of the metaphyseal-epiphyseal spans bone seems to ensure the stop evolving of the deformity and also the disappearance of pain.

1. Principle: The personal method of treatment in knee and hip arthrosis (as SICOT/SIROT Congress - Cairo, 2003; the IXth AOLF Congress - Montpellier, 2004; Drayfus Heath Foundation, vol I, 2003; Orthopedics and Traumatology Review - Bucharest, 2003, no. 3-4) follows:

1.1. stimulation of the local troficity (venous draining, revascularisation of subcortical structures) *(figure no.9).*

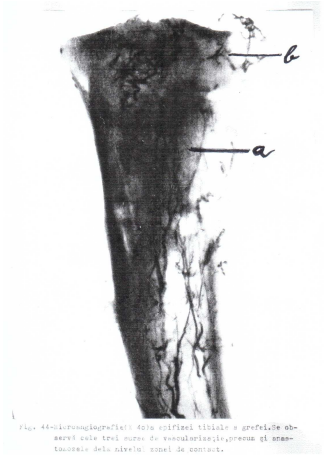


Figure no.9: *The vasculature of proximal extremity of the tibia (experimental, on dog), a = is observed the prevalence of endostic arterial vasculature in the shaft and of periostic one in the epiphysics (b).*

1.2. remodeling of bone architecture of the proximal tibial epiphysics (femoral) by stimulating with osteoprogenitor products, the bone restructuring according to the new power lines which require these epiphysics *(figure no.10a, 10b).*

Figure no.**10a**

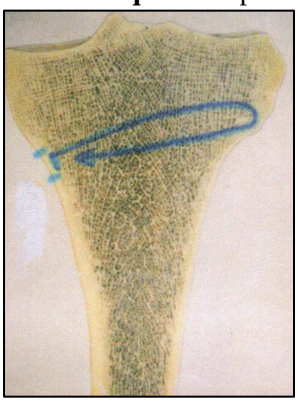
Figure no.**10b**

Figure no.10. *After spongioclasia appear arteries which perforates the plate and feeds the epiphysics (experimental piece).*

1.3. pain sedation through decompression venous drainage.
1.4. epiphyseal denervation.
1.5. local restructuring (vessels, bone soak, autologous blood with osteostimulative elements).

2. Indications: These are predominantly subjective, depending on patient option.
2.1. early stages of the disease (I-II).
2.2. related diseases that could be aggravated by an invasive intervention.
2.3. obesity (which is not resolved by the patient on time).
2.4. patient refusal relating to an invasive intervention (fear, single persons, impossible interruption of daily activities and ambulatory treatment).

3. Technique: The procedure is simple and has been presented at other times.



3.1. topographic marking of the drilling place (in case of tibia, 5-8mm proximal to the tibial tendon patellar tuber, midway between the anterior and medial edges of the tibia; in case of femur, the lateral side, immediately above the line passing through the top edge of the small trochanter) *(figure no.11).*

Figure no.11: *Spongioclasia schedule in the proximal extremity of the tibia.*

3.2. perforation of anterior-medial cortical of the tibia or lateral cortical of the femur *(figure no.12a, 12b).*

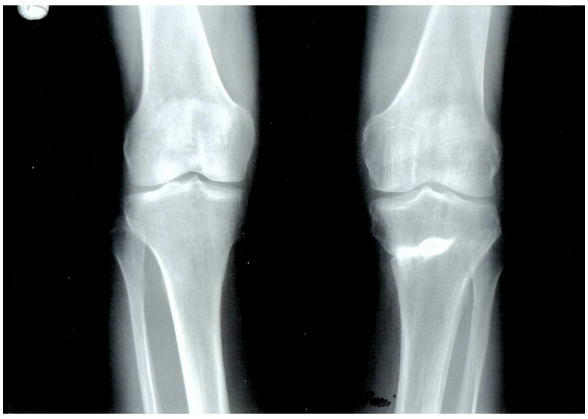


Figure no.**12a**

Figure no.**12b**

Figure no.12. a, b*: Left knee arthrosis, 3 months (a) and 6 months after valgus osteotomy, heterogeneous > graft (pig) and instillation of osteoinductive preparation (SIPS aspirated, dexamethasone, homologous STEM cell culture), which is observed (b) a diversion of vertical spans bone, after the new power lines*

3.3. subcortical spongioclasia, circular with a curved instrument, especially blunt *(figure no.13a, 13b, 13c).*

Figure no.**13a**

Figure no.**13b**

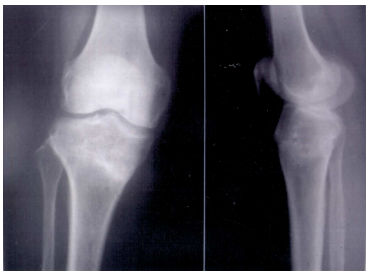


Figure no.**13c**

Figure no.13 (a, b, c): *right idiopathic knee arthrosis (IVth stage), before surgery **(a),** after surgery [**(b)** = valgus osteotomy with heterograft, 2 months after] and another 3 months after instillation (by drilling) of osteoinductive preparation **(c).***

For the proximal end of femur, we practice the approach (drilling) to the lateral cortical, opposite the small trochanter. The first time is to drill 2-4 canals of 3-5mm in diameter until the subchondral area of the femoral head (in case of images "in the mirror" from the acetabulum, the drilling should pass transarticular until the acetabulum injury). The second time consists in a circular spongioclasia in the proximal femoral metaphysics. In these areas created by drilling, we introduce the osteoinductive preparation (aspirated from posterior-superior iliac spine, which after clot tixotropy, is supplemented with dexamethasone, osteoformative STEM cells cultures, autologous or homologous). We mention the need to maintain a quantity of 1-2 ml of culture medium, which inject at the same time with cell centrifuged.

3.4. perforation of the metaphyseal tibial plate (especially) in 3-4 places (towards distal) with the same tool, to facilitate penetration of new vascular buds in the subchondral bone, intraosseous shaft circulation (tibia nutritional vessels) being poor *(figure no.14).*

Figure no.14: *perforation of the metaphyseal tibial plate (especially) in 3-4 places (towards distal) with the same tool, to facilitate penetration of new vascular buds in the subchondral bone, intraosseous shaft circulation (tibia nutritional vessels) being poor.*

3.5. introduction of 2cc of osteoprogenitor product (aspirated from posterior-superior iliac spine + dexamethasone, auto- or homologous culture of osteoformative fibroblasts - STEM). The marrow aspirate product is allowed to clot, then by thixotropy the clot is lysates (in this moment releases osteostimulative cytokines) and add the above ingredients *(figure no.15).*

Figure no.15: *Culture of cells with osteoformative potential (medulocytes like STEM cells) in spongy bone, in special culture medium (fluorescence - tetracycline).*

4. Postoperative conduct:
4.1. Progressive resumption of walking, with stick (crutches) after 24 hours, with progressive support, until the 21st day.
4.2. Physiotherapy since the 21th day (3 courses per year, for 2-3 years); spa-physiotherapy in the summer time *(figure no.16a, 16b)*

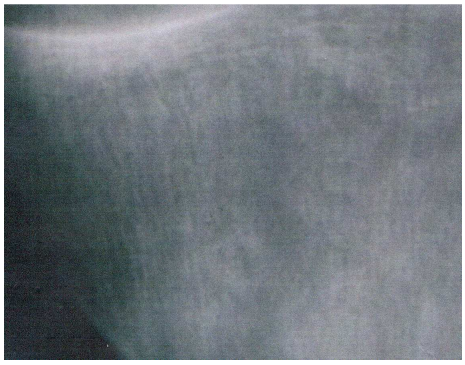


Figure no.**16a**

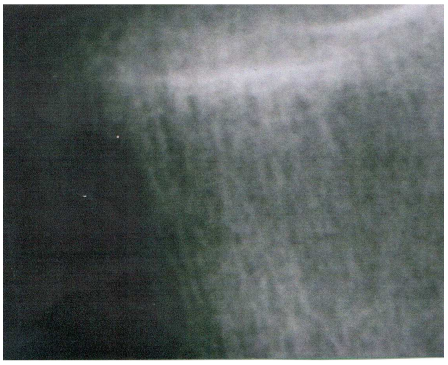


Figure no.**16b**

Figure no.16 (a, b): *Internal tibial plateau in the knee osteoarthritis it is observed the reorientation of the bone trabeculae and regeneration of the subchondral bone after 1 year from spongioclazia;*

5. Clinical results were evaluated (international quotations) following:
a. the staging of the diseases:
- ☐ knee - Ahlback.
- ☐ hip - Ficat, Arlet, Bombelli.

scores, evolution:
- ☐ knee - Koos, Larson, Goldberg,
- ☐ hip - Harris, USS

b. X-ray examination, MRI, CT.
c. puncture biopsy (when we had the chance) *(figure no.17a, 17b)*

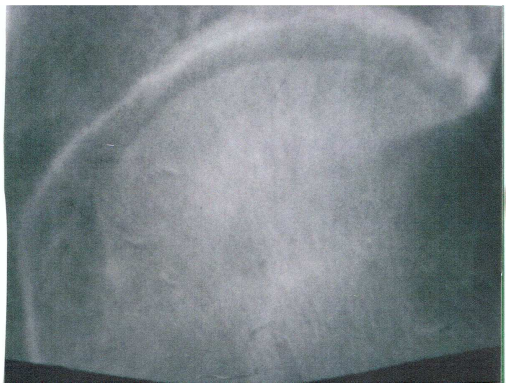


Figure no.**17a**

Figure no.**17b**

Figure no.17 (a, b): *Hip osteoarthritis with secondary incipient AFHN before and after 6 months from surgery; it is observed a new trabecular bone architecture*

Conclusions

The surgery in hip arthrosis, NACF and knee arthrosis may include in their arsenal operations that use or promote the biological processes of osteocartilaginous remodeling, in terms of judicious choice of the stage of these conditions, ensuring a local morphology as favorable to the normal biomechanics of the affected joints and using the cell-biology and biochemical gains in the growth factors area.

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