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INSTITUTE OF SPINE AND JOINT DISEASES” UNDER NATIONAL ACADEMY
OF MEDICAL SCIENCES OF UKRAINE**

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**THE ROLE OF THE CONCEPT OF JOINT DISEASES CAUSED BY HEREDITARY
PREDISPOSITION IN THEORETICAL AND APPLIED MEDICINE**

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Introduction

Joint diseases caused by hereditary predisposition (JDCHP) are a group of genetically determined joint diseases caused by anomalies of the joint structure, which determine the particularities of its functioning. The primary cause of such joint diseases is the biomechanical factor in the form of structural anomalies. Those structural anomalies lead to disturbance of the joint loading, which has a double destructive effect: macromechanical effect with macrodestruction of the joint with forming its disarticulations, dislocations or deformations, and micromechanical effect with, first of all, destruction of joint tissues and articular cartilage in critical loading areas. Destruction, in turn, causes the transition of reparation processes to the stage of dysregeneration, which is implemented as an inflammatory and dystrophic process, and clinically - as arthrosis. All these phenomena are present in each case and always take place in interaction with the obligatory influence of environment factors.

Clinical polymorphism, which is typical for dysplastic pathology, rules out the possibility of any standard assessments and approaches.

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Joint diseases caused by hereditary predisposition are considered in the time aspect, starting from fetal anlage of organs and throughout the life. Consequently, joint diseases caused by hereditary predisposition are the diseases of the whole life of a person, without limitation of age, sex, and joint localization, and with various particularities of their clinical course.

Research objective: Showing the importance of the concept of joint diseases caused by hereditary predisposition for theoretical and applied medicine.

Materials and methods

We used the method of conceptual modeling and clinical, radiological and statistical methods as well.

Research findings

The results of research at the genesis level were aimed at revealing the essence of the origin and development of joint diseases caused by hereditary predisposition, and the research results were implemented as theories, concepts and laws. The following are the main concepts built: "Dysplastic hereditary diseases of the joints and spine" (DHDJS), the theory that is the basis for all further orthopedic studies; "Deformity triggering arthrosis" (DCA) as a special form of arthrosis, which is inherent only and exclusively to joint diseases caused by hereditary predisposition, and therefore it is considered along with deformity caused by arthrosis: DHDJS – DCA. In these cases, the inflammatory and dystrophic process arises due to the destruction of joint tissues, which is caused by structural anomalies and a violation of the loading of the joint, and the disease proceeds according to the formula: anomalies of the structure - violation of loading - destruction - reactive changes. This situation corresponds to its name - deformity triggering arthrosis (deformity that leads to arthrosis).

Deforming arthrosis is characterized by the course proceeding as per the "inverse" formula: alteration - destruction - violation of loading and structural anomalies. It is quite natural that these cases of arthrosis require different diagnostic and treatment tactics, and they have different prognosis.

Carried out at the essential level, the studies were aimed at revealing the essence of individual groups of diseases and certain general phenomena. As a result, the following theories and concepts were developed: theory of hereditary scoliosis; the concept of osteochondrosis of the lumbar spine; the concept of hereditary susceptibility of diseases such as dislocation of the femoral head, aseptic necrosis and epiphysiolysis of the femoral head; and the concept of "meniscogenic syndrome caused by hereditary predisposition". The last of these concepts allowed us to distinguish three types of meniscus pathology depending on its genesis - dysplastic, traumatic or pathic. As a result of the concept developed, different signs and symptoms of the knee joint pathology are united in a homogeneous group with a common causal factor that is genetically determined anomalies of the structure of the meniscus and the knee joint. For the first time, the meniscogenic syndrome caused by hereditary predisposition was substantiated as a nosological form of dysplastic pathology of the knee joint. At the same time, direct and indirect meniscogenic syndromes were identified: a direct meniscogenic syndrome is caused by hereditary predisposition, with the primary cause factor of meniscus destruction being an abnormal meniscus; an indirect meniscogenic syndrome, in which the destruction of the meniscus is a result of the force effects of abnormal bone structures of the knee joint. The substantiation of meniscogenic syndrome caused by hereditary predisposition changed the diagnostic and treatment tactics for meniscus pathology, which made it possible to improve the results of treatment for meniscus pathology.

The studies carried out at the phenomenological level turned out to be fruitful. These studies resulted in a description of a group of new syndromes caused by hereditary predisposition: hyperpressure of the hip joint volume; hypoplasia of tibial condyles; dysmorphia of the knee joint meniscus; patella imbalance; loading disorders of the patellofemoral joint; varus (valgus) deformity of the knee joint; apophyseal tendopathy of the tibial tuberosity; periosteotendopathy of the calcaneal tuberosity; and post-resetting hyperpressure in congenital hip joint dislocation.

The descriptions of the syndromes above are used in the medical practice.

Conclusions

Thus, the new concept of the joint diseases caused by hereditary predisposition made significant adjustments in orthopedic science and practice. The concept laid the foundation for the ideas about *Orthopedic Arthrology*. Thus, substantial changes were made in the structure of diseases of the joints and the spine, which is the main task of clinical medicine researches.

CONTEMPORARY APPROACHES IN REHABILITATION OF ATHLETES WITH TRAUMATIC INJURY OF THE SHOULDER JOINT

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The shoulder joint injuries are frequent in sports, with their incidence being within the range of 16 to 55% in athletes of various categories. A close functional relationship between the elements of the shoulder joint, and even a small damage to some of those elements involves other articular structures in the pathological process; it, in turn, contributes to the progression of anatomical and functional changes of the rotator cuff of the shoulder. The main reason of pathological symptoms is the chronic micro-traumatization of the shoulder joint, which accompanies great sports. The relevant vector of this pathology is the development of rehabilitation programs based on modern methods of physical rehabilitation, orthopedic means, and modern technical means.

The research objective: Studying the efficiency of integrated programs with the use of physiological taping and sling-therapy in the rehabilitation of athletes with traumatic injury to the shoulder joint.

On the basis of the Kinesiology Laboratory of Zaporozhye National University, we followed up 26 volleyball athletes with lesions of the shoulder joint and its ligaments, mostly at right side, which were divided into the main and control groups (13 persons in each group). The prescription of traumatic injury in all the athletes was within the range of 2 weeks to 2 months. The efficiency of the proposed measures was evaluated according to the dynamics of the visual analog scale of pain, the total algofunctional index of the shoulder joint, and the range of active motions in the shoulder joint.

The following conventional approaches to the restoration of the function of the shoulder joint are used in the control group: isotonic and dynamic stabilization exercises to train shoulder muscles and return gradually the full range of motions in the shoulder joint; exercises with metered resistance and loading on sporting equipment and with objects; post-isometric exercises; and massage of the injured zone.

The comprehensive program of physical rehabilitation of athletes in the main group also included:

- muscular techniques of kinesiological taping for passive stabilization of the shoulder joint in case of lesion of the tendons of the rotational shoulder cuff, as well as the relaxation of the muscles of the shoulder girdle (taping the supine, deltoid, and biceps muscles was used predominantly). The main advantage of functional taping is the ability to maintain the full range of motions when an elastic tape is applied;
- a workout complex on a sling system (Ekzarta kinesitherapy complex) for active stabilization of the shoulder joint and the upper limb belt.

Sling therapy is a method of physical rehabilitation using suspended systems for the entire body or extremities. When doing exercises, the slings remove axial load from the joints and provide support to the body. Various options for suspending the limbs give the opportunity to rule out relatively "strong muscles" from workout, to engage only those muscular groups that need training, and also to form new more rational patterns of motions.

Passive suspension systems makes it possible to eliminate the force of gravity, thus make accentuated effect on the muscles to activate them, which results in a training load becoming more efficient. Sling systems also make it possible to select the optimal level of workout regimen for each athlete, taking into account the individual particularities of the course of the post-traumatic period, the severity of the pain syndrome, etc. Sports suspension systems are quite mobile; they do not require a specific stationary fastening that allows them to be used in rehabilitation centers and even at home after a previous training.

Following the results of the initial examination, all the athletes had a moderate pain syndrome that is the most common clinical sign of traumatic joint injury. Estimated by the total algofunctional index of the shoulder joint, functional abilities in patients of both groups were equivalent and lowered at the beginning of the study in comparison with the norm (9.08 / 9.34 scores). Goniometry indices also were reduced almost twice in the main and control groups.

When doing a repeated examination in two months of application of the program, the severity of the pain syndrome in both groups was reduced. Thus, at the end of the study, the visual analogue pain score decreased by 60.48% in the main group in comparison to 51.61% in the control group. Along with this, a significant decrease in the algofunctional index of the shoulder joint was observed in all its components (motions in the sagittal and frontal plane, the possibility to put the hands behind the back, strength and palpation stress of the muscles of the neck and shoulder girdle). The decline in the total index was 59.76% and 42.07% in the main and control groups, respectively. Improvement also was found in both groups when studying mobility indexes of the shoulder joints, more pronounced in flexion and abduction, however, the positive dynamics was higher in the main group. For example, an increase in the flexure motion range was 38% in the main group and 21% in control group; extension motion range was 45% and 21% respectively; and abduction motion range was 35% and 13% respectively.

Thus, the use of modern physical therapy techniques on sling systems as part of integrated rehabilitation programs contributes to greater reduction of the pain syndrome and to improvement of functional indices of the shoulder joint; and it increases the efficiency of patient recovery.

HIP JOINT REPLACEMENT WITH IMPLANTS OF THE ITO-MOTOR SICH SYSTEM

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Introduction

One of the most basic criteria for quality of life is the ability to actively move without pain and limitation of the range of motion. However, in everyday life, we repeatedly meet people suffering from pain in motion.

In Ukraine, almost 330,000 primary joint diseases among adults and 15,000 among children are registered annually, which is 6.4% of all patients seeking medical care. Every 4th orthopedic patient suffers from joint diseases, with 60% of them being of working age. In 11.5% of cases they are disabled, and 60% of them are disabled persons of Group 1 and 2.

That is why, Motor Sich JSC, together with experts of the Institute of Traumatology and Orthopedics under the National Academy of Medical Sciences and Zaporozhye State Medical University developed a hip joint implant system, and in 2008, Certificate of its state registration was obtained.

Motor Sich JSC has been producing and selling medical products for more than 15 years. Разработаны и внедрены в практику системы остеосинтеза, производится хирургический инструментарий. Systems of osteosynthesis were developed and introduced into practice; also, surgical instruments are produced. The company has been represented in the market of medical equipment since 1994, and today we can say with confidence that the company has fully proved its competitiveness.

The presented ITO-Motor Sich system is a new development for primary and revision hip joint replacements. The work was initiated by the Chairman of Mr. Boguslaev V.A., the President of the Board of Directors of Motor Sich JSC, and Gayko G.V., the Director of the Institute of Traumatology and Orthopedics under the National Academy of Medical Sciences of Ukraine, with the assistance of Paton B.Y., the President of the National Academy of Sciences of Ukraine, together with E.O. Paton Electric Welding Institute (PWI), I.M. Frantsevich Institute for Problems of Materials Science under the National Academy of Medical Sciences of Ukraine, and V.M. Bakul Institute of Superhard Materials under the National Academy of Medical Sciences of Ukraine. The design of this implant incorporates the most modern achievements of Ukrainian science and technology, and it meets international requirements for implants of ISO. The ITO-Motor Sich system incorporates the principle of modularity and interchangeability of the implant elements, which makes it possible to select the implant design individually for a particular patient, taking into account the nature of the disease and the anatomical features of the affected hip joint.

Materials and methods

For the period from January 2015 to May 2017, the Department of Traumatology and Orthopedics of Motor Sich LLC clinic performed 133 operations on hip joint replacements using ITO-Motor Sich system. 94 patients underwent a primary total hip joint replacement with fixation of the components. Patients with coxarthrosis stage III prevailed (91 patients, 96%); three patients were operated on for rheumatoid arthritis. The age ranged from 26 to 64 years. 34 patients were operated on using cemented implants; all the patients with hip fractures aged 64 to 94 years. Revision hip joint replacement was performed in 5 patients.

Research findings and discussion

All the patients acquired a support limb; no cases of implant instability were observed. The follow up period is up to 3 years.

We analyzed the results of the recovery of function in 133 patients.

In subjective estimation of the results of the treatment, which was based on the analysis of pain, by the time of examination, 50.0% of the patients considered the treatment results to be excellent; 43.3% of the patients considered the treatment results to be good; and 6.7% of the patients noted the improvement.

The functional results of the survey looked very good at the time of examination. All the patients could bend the leg in the hip joint to an angle of 90° or more. Lack of extension of more than 5° was in one case only, and it should be noted that the patient achieved a significant improvement in joint function as a result of the surgery.

At the time of re-examination and in the long-term period, analysis of the gait showed that 89% of patients could walk without a cane and lameness. When walking for long distances, 5 patients (11%) used a cane or crutch supported on the forearm from the “healthy” side. In comparison with the pre-operative situation, all the patients had a significant improvement in their gait by the time of re-examination. More than two thirds of the patients could take regular walks.

Conclusion

The use of the ITO-Motor Sich hip joint implant system showed positive results in 96% of patients within 3 years after surgery. Hip joint implant with ITO-Motor Sich system is an efficient treatment method for coxarthrosis, and it significantly improves the quality of life for patients.

USE OF OMS AND OMS-A BONE GRAFTS IN RECONSTRUCTIVE ORTHOPEDICS

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The study relevance is determined by the dissemination of degenerative-dystrophic diseases of the spine and joints, which require surgical treatment, as well as an increase in the number of patients. One of the options for improving the regenerative capacity and bone defect plastics of various localizations is the use of biocomposite components of various origins that would contribute to restoring the structural integrity of the bone.

Research objective: Showing the experience in using OMS and OMS-A grafts developed by State Institution "Professor M.I. Sitenko Scientific Research Institute of spine and joint diseases" under National Academy of Medical Sciences of Ukraine, Kharkov, Ukraine.

Materials and methods

A new comprehensive methodology was developed by the transplant department of the system of support and motion of the State Institution "Professor M.I. Sitenko Scientific Research Institute of spine and joint diseases" under National Academy of Medical Sciences of Ukraine: obtaining grafts from xenogeneic or donor allogenic bone with subsequent dehydration or saturation with ceftriaxone for the plastics of complex defects in human bone skeleton.

For the period from 2011 to 2016, 643 patients were operated, with our OMS and OMS-A products implanted in them. This paper analyzes the remote results of surgical plastic bone treatment in 187 patients with various diseases of the musculoskeletal system. The patients aged 1 to 18 years at the time of admission; Table 1 shows patient age distribution.

*Table 1
Patient age distribution*

Age	1 to 7 years	7 to 14 years	14 to 18 years
Number of patients, n (%)	57 (30)	102 (55)	28 (15)

As can be seen, the majority of the patients examined are aged 7 to 14 years - 102 (55%). Table 2 shows patient distribution depending on the nosology and type of biocomposite material. Most often, corticocancellous granules saturated with ceftriaxone were used in plastics of large bone defects.

Research findings

Following the X-ray examination data, the restructuring of bone tissue in the area of operation was achieved within the period of 6 to 12 months. In a longer term period (in 3 to 5 years), the bone structure in patients, in most cases, corresponded to a normal bone, with plastic material traces being absent or insignificant. No specific implant-induced reactions, such as encapsulation, and let alone rejection, were detected.

*Table 2
Distribution as per nosology and type of biocomposite materials*

Biocomposite materials	Bone grafts saturated with ceftriaxone		OMS and OMS-A bone grafts		Total
	Corticocancellous granules	Volumetric bone grafts	Corticocancellous granules	Volumetric bone grafts	
Surgery for neoplasms	19	8	13	2	42
Surgery for replacement of volumetric defects	51	12	30	5	98
Surgery to lengthen bones	18	7	16	6	47
Total	88	27	59	13	18

Conclusions

The use of transplants, which are saturated with ceftriaxone, and dehydrated implants has several advantages:

- The unique methodology of extraction of non-collagen antigenic proteins by milder and gentle methods increases biocompatibility of specimens, with the microstructure of collagen and mineral bone skeleton not damaged, which is essential to preserve osteoinductive and osteoconductive properties;
- The developed method of intensified saturation of bone tissue with ceftriaxone makes it possible to substantially reduce the percentage of suppurations in clinical use, however, the graft storage temperature should be below zero, and it has a shelf life of 3 months;
- The method of bone tissue dehydration was developed in the department, which makes it possible to increase the graft shelf life to 3 years at room temperature;

- Replacement of bone defects in reconstructive surgeries improves conditions for reparative regeneration of bone tissue and contributes to the restoration of bone integrity;
- It is most appropriate that such surgeries be carried out with bone grafts and allogeneic implants.

DIAGNOSTIC AND PROGNOSTIC ALGORITHM OF THE PROGRESSING OF HIP JOINT OSTEOARTHRITIS

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Incidence of osteoarthritis deformans of the hip joint (coxarthrosis, CA) is more than 40% of all forms of osteoarthritis. This disease usually ends with a progressive disorder of the hip joint function that causes patient disability. Incidence of coxarthrosis increases sharply after 45-50 years. According to some authors, the progressive nature of the coxarthrosis leads to a decline in capacity for work in 60% of cases. All these facts testify to the high medical and social significance of coxarthrosis, which significantly impairs a patient's quality of life and also leads to huge social and economic costs of society. Foreign literature highlights idiopathic hip joint arthrosis with rapid destruction (Rapidly destructive osteoarthritis of the hip joint). The largest group of observations was provided by British orthopedists - 18 patients (16 women and 2 men). However, reliable factors and markers of the development of any form of the coxarthrosis progression are unknown at present. A diagnostic and prognostic algorithm of the coxarthrosis progression has not been developed yet.

Research objective: Developing diagnostic and prognostic algorithm of the progression of the hip joint osteoarthritis.

Material and methods

The basis of the development of the diagnostic and prognostic algorithm of the progression of osteoarthritis of the hip joint was a comprehensive study of 291 patients with hip joint osteoarthritis of various etiologies, which were treated at clinic of State Institution "Institute of Traumatology and Orthopedics of Ukraine" under National Academy of Medical Sciences of Ukraine (NAMN), Kiev, Ukraine. Taking into account publication data and the working classification developed by us, we identified rapid, moderate and slow forms of coxarthrosis progression. Idiopathic, dysplastic, and post-traumatic forms of coxarthrosis were determined as per etiological factors. The value of the risk factor (probability of prevalence of the sign) of the progression of coxarthrosis in patients was determined by

the formula: $k = \frac{N_1}{NI_{\max}}$, where N_1 - number of examinations wherein there was a sign of the disease; N - total number of examinations; I_{\max} - maximum index score for the sign of the disease.

The value of the risk of the coxarthrosis progression (CRCP / KRPKA) was determined by the formula:

$$KPIKA = \sum_1^n X_n,$$

where $X_n = I_n \cdot k_n$ – meaning of specific indices of signs of coxarthrosis progression in this patient. The CRCP values for all patients with various forms of the coxarthrosis progression and various etiologies are determined. The diagrams of the CRCP values calculated for each etiological group were developed; the probability of progression of the pathological process was defined, as well as a block diagram for predicting the course of idiopathic and dysplastic coxarthrosis.

Research findings

Indexation and dissemination of signs of coxarthrosis progression were conducted, taking into consideration the significance of criteria of rapid progression of the pathological process. The verification of the diagnostics criteria for the risk of coxarthrosis progression was performed in 291 patients with hip joint deforming arthrosis of stage IV as per Kellgren classification with different etiologies (idiopathic, dysplastic and posttraumatic), and various forms of pathological process progression (rapid, moderate and slow). At the same time, the values of the criteria of the risk of coxarthrosis progression (CRCP) were obtained.

To use the diagnostic and prognostic algorithm of coxarthrosis progression, it is necessary to fulfil the following procedure:

Step 1: Examining the patient for clinical, radiological, and instrumental signs: gender; a patient's age at the beginning of the disease; years, body mass index; Harris score; increased professional static load, if any; concomitant chronic internal diseases, if any; diseases of large joints in immediate family, if any; type of bone formation as per Bombelli classification; a bone-like rearrangement of the hip joint head or /and acetabulum; the degree of density of the iris;

Step 2: Calculating the value of the risk criterion for the coxarthrosis progression. To do this, we should calculate the significance of specific indices of signs of the coxarthrosis progression in this patient, using the indexation table and the prevalence coxarthrosis progression signs;

Step 3: Following the data obtained from physical and X-ray examination and the past medical history of the patient, determine the coxarthrosis etiology (idiopathic, dysplastic, post-traumatic or other aetiology);

Step 4: In idiopathic coxarthrosis with the CRCP value more than 6.91, a rapid form of the coxarthrosis progression is observed. In idiopathic coxarthrosis with the CRCP value less than 3.97, a slow or moderate form of the coxarthrosis progression is observed. In idiopathic coxarthrosis with the CRCP value within the range of 3.97 to 6.91, a combination of all three forms of the coxarthrosis progression is observed.

In dysplastic coxarthrosis with the CRCP value greater than 6.79, a rapid coxarthrosis progression is observed. In dysplastic coxarthrosis with CRCP value less than 3.59, a slow or moderate coxarthrosis progression is observed. In dysplastic coxarthrosis with the CRCP value within the range of 3.59 to 6.79, a combination of all three forms of the coxarthrosis progression is observed. The coxarthrosis progression forms could not be determined by this algorithm in post-traumatic coxarthrosis or in coxarthrosis of other etiology.

Conclusions

Based on the comprehensive examination of 291 patients with deforming arthrosis of the hip joint of various etiologies, a diagnostic and prognostic algorithm and a block diagram of the coxarthrosis progression were developed.

In patients with idiopathic coxarthrosis with the CRCP value more than 7.06, a rapid form of the coxarthrosis progression is observed in 100% of cases; with the CRPC value less than 3.97 a rapid form of the coxarthrosis progression is not observed in 100% of cases. When the CRPC value is within the range of 3.97 to 7.06, a combination of all three forms of the coxarthrosis progression is observed in patients.

In patients with dysplastic coxarthrosis with the CRPC value more than 6.95 a rapid coxarthrosis progression is observed in 100% of cases; with the CRPC value less than 4.09 a rapid form of the coxarthrosis progression is not observed in 100% of cases. When a CRPC value is within the range of 4.09 to 6.95, a combination of all three forms of the coxarthrosis progression is observed in patients.

In case of post-traumatic coxarthrosis, this algorithm is not informative. This coxarthrosis type progresses mainly depends on the severity of the injury received.

Implementation of the diagnostic and prognostic algorithm for the coxarthrosis progression will improve the diagnosis of this severe orthopedic pathology to develop a differentiated approach to treatment and prevention of coxarthrosis.

CAUSES AND TREATMENT OF COMPLICATIONS AFTER HIP JOINT REPLACEMENT

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Relevance

Due to the widespread introduction of the hip joint replacement into clinical practice, the number of related errors and complications is increasingly growing. The following complications are most common: aseptic instability of the components, dislocation of the implant head, heterotopic ossification, peri-implant femoral fractures, purulent complications and pain associated with instability. Development of certain complications of the hip joint replacement requires revisional surgeries, with their number increasing every year worldwide, including Ukraine. It definitely requires orthopedists to analyse in details the causes leading to negative consequences to prevent them from happening in the future. Everything of the above determines the relevance of the research carried out.

Research objective: Improving the results of the total hip joint replacements by reducing the number of errors and complications.

Materials and methods

339 patients with complications after the total hip joint replacement were examined in 344 cases. This work studied the structure of complications of the total hip joint replacement; it determined complication the causes; and it analyzed the results of the complication treatment.

Research findings and discussion

Complications after the hip joint replacement were detected in 339 patients (in 344 cases) who underwent the total hip joint replacement. The complication structure was as follows: aseptic instability of the components was found in 158 cases (45.9%); dislocation of the implant head was found in 41 cases (11.9%); para-articular heterotopic ossification was found in 30 cases (8.7%); peri-implant femoral fractures were found in 25 cases (7.3%); pain in the replaced hip joint (not associated with instability) was found in 35 cases (10.2%); and infectious complications were found in 55 cases (16.0%).

The total instability of the components of the hip joint implants was observed in 43 cases (27.2%); acetabular component instability was observed in 65 cases (41.1%); femoral component instability was observed in 50 cases (31.6%).

Components with cementless fixation type dominated among unstable acetabular components - 59 components (54.6%). Components with cemented type of fixation dominated among unstable femoral components - 53 components (57.0%). Aseptic instability of components was detected in 51 cases (32.3%) in less than 5 years after the surgery; in 64 cases (40.5%) in 5-9 years after the surgery; and in 43 cases (27.2%) in 10-14 years after the surgery. Most implants were destabilized in a period between 5 and 9 years after the replacement surgery.

The influence of such groups of factors was studied: factors associated with the patient; factors associated with the surgeon; and implant-related factors.

The statistical analysis established a reliable correlation (χ^2) between the instability of the acetabular component and the following factors: patient age; a hip joint disorder, the implant manufacturer, the Barnett-Nordin index, and cystoid degeneration of the acetabulum before surgery.

A reliable correlation (χ^2) was established between the instability of the femoral component and the following factors: patient age; the implant manufacturer; the Barnett-Nordin Index; and the Spotorno-Romagnoli Index.

The following causes of the instability of the acetabular component of the hip joint implant were found: female sex of the patient; obesity; age; NMED implants; osteoporosis; cystoid degeneration; incorrect position of a component; liner wearing; errors in cementation. The causes of the instability of the femoral component were the male sex of the patients; the patient age of 60 to 74 years; obesity; severe physical labor; osteoporosis; inadequate choice of fixation type; inadequate choice of femoral component shape; liner wearing; alteration of the relationship between the implant head and the tip of the tr. major of the femur; varus position of the component in the bone marrow canal of the femur; cylindrical canal type; alteration of the technique for component cementation.

Reasonable causes of the implant head dislocation were established: obesity; incorrect position of the acetabular component; fracture and false joint of the femoral neck; dysplastic coxarthrosis; diameter of 28 mm of the head; anterolateral Müller access.

The causes of para-articular heterotopic ossification were hip joint osteoarthritis, cementless fixation of the components, surgery duration more than 2 hours, blood loss more than 500 ml, postoperative hematoma.

The true cause of peri-implant fractures was osteoporosis of the femoral neck determined by the Barnett-Nordin Index. The cause of the pain syndrome, which was not associated with the instability of the components, was the spine disorder, i.e. degenerative-dystrophic changes in the anterior lumbar spine.

The causes of purulent complications of femoral implants were chronic infectious diseases of the internal organs, instability of components, more than 2 surgeries underwent by the patient. Infection of Gram-positive microorganisms was established microscopically, culturally, and serologically in patients with purulent complications, which indicates the predominantly endogenous pathway of infection.

The results of the treatment of complications of the total hip joint replacement were analyzed. In patients with instability of the acetabular component, the results of the revision replacement of the acetabular component were the best in acetabulum defects of I and II types as per Paprosky classification, and revision implantation of primary acetabular components with a cementless fixation type. Thus, in 10 years after the revision hip joint replacement, the absolute majority of acetabular components (33 components, 86.8%) remained stable ($t = 9.3$, $p < 0.05$). The average lifetime of acetabular components (primary) with cementless fixation type, which were implanted in revision surgery, was 8.2 ± 0.5 years, and with the cemented fixation type it was 4.5 ± 0.5 years.

The results of the revision replacement of unstable femoral components with cemented and cementless fixation did not have a significant difference in 10 years after the revision. Thus, an average functioning period for the femoral components with cementless fixation, which were implanted in revision, was 7.8 ± 0.5 years and 8.1 ± 0.5 years for the femoral components with cemented fixation.

Aseptic instability relapse was observed in 7 cases only, 5 of which (71.4%) had cemented fixation.

In total instability, no difference in the results of the revision implantation was detected when using primary components only, and the combination of primary components with revision reconstructive systems of components. In 10 years, the absolute reliable majority ($t = 7.3$, $p < 0.05$) of cases were the cases with component stability (35 cases or 81.4% of cases). The relapse of instability of one component was observed in 8 cases (18.6%) of the total revision component replacement.

Relapse of the dislocation of the hip joint implant head after a closed reduction of the dislocation was observed in 72.7% of cases, and after surgical treatment only in 20.6% of cases. The efficacy of surgical treatment of dislocations is reliably higher in comparison to closed dislocation reduction ($\chi^2 = 15$; $p < 0.01$).

In the treatment of para-articular heterotopic ossification in patients with hip joint contracture $> 20^\circ$ in two planes, the most efficient method of the joint function restoration and treatment is operative replacement of ossificates, although the recurrence of ossification was observed in 70% of cases.

The only efficient treatment methods for peri-implant fractures were the reposition of fragments followed by metal osteosynthesis in 100% of cases. No relapses of the femur fracture or the false joint were detected.

In case of vertebrogenic pain, the best treatment results were found in patients with lesion of the back portion of the lumbar spine. Conservative treatment efficiency was proven in all the patients with both positional and neuropathic pain.

Conclusions

The hip joint replacement complications were as follows: aseptic instability of the components in 158 cases (45.9%); dislocation of the implant head in 41 cases (11.9%); para-articular heterotopic ossification in 30 cases (8.7%); peri-implant femur fractures in 25 cases (7.3%); pain in the joint implant (not associated with instability) in 35 cases (10.2%); and infectious complications in 55 cases (16.0%).

Reliable complication causes were obesity, ancient age, obsolete implant structure, osteoporosis (according to the Barnett-Nordin and Spotorno-Romagnoli Indexes, cystoid degeneration of the acetabulum, incorrect component position, polyethylene liner wearing, errors in cementation and chronic inflammatory diseases.

The most efficient treatment methods for complications were revision joint replacement with replacement of components and plastics of bone defects, if any. The only efficient treatment method for peri-implant femoral fractures was open repositioning of the debris and metal osteosynthesis. In case of vertebrogenic pain, the best results of treatment were found in patients with lesion of the back portion of the lumbar spine. Conservative treatment proved its efficiency in all the patients with both positional and neuropathic pain.

CONDITIONS FOR REVISION HIP JOINT REPLACEMENT IN CASE OF BONE DEFECTS (BIOMECHANICAL MODELING)

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Introduction

Widespread use of the hip replacement method [1-6] is accompanied by an increase in the number of complications of this type of surgery. One of the most important complications of the primary hip joint replacement is aseptic instability of the implant components [1, 4, 5]. The results also deteriorate over time and depend on the biomechanical load on the component: instability was more than 13.0% in 10 years after the acetabular component replacement, according to the Swedish Registry (Sv.reg) of 2008, whereas the instability after the femoral component replacement was only 4. 0%. [7-9].

It is also known that in fact, up to 80% of patients in Ukraine seek medical care late, when they already have substantial bone defects in the hip joint implant, which complicates greatly the revision joint replacement [11, 14-16]. The biomechanical conditions for implantation of a revision acetabular component and for rearrangement of transplanted bone are not definitely defined [15-18]. Well-known researchers say about the failure of using bone allograft almost in 100% of cases. Such controversial data suggest a lack of a unified approach to solving the problem of revision arthroplasty in patients with aseptic component loosening and defects [17-19].

Research objective: Biomechanical analysis of the effect of the implant acetabular component position on the development of aseptic instability of the component and biomechanical conditions of the revision hip joint replacement in patients with bone defects.

Materials and methods

The implant femoral component head shifts due to the body weight, deforming the surface of the acetabular component, which is much softer. The elastic deformation of the acetabular component triggers a reaction forces in the form of a distributed pressure (p) onto the surface of the implant head.

In cementless implantation of the implant acetabular component in the recommended position, the maximum contact area of the component and the acetabular bed bone (100%) is possible, with the pressure onto the acetabular bone not exceeding the strength limit of cancellous bone of 500 N/cm².

Research findings and discussion

If the acetabular component is set incorrectly (an ultra-low deviation angle of 25°), at an internal limb rotation of 10°, the load will be $P = 691.3 \text{ H} / \text{cm}^2$, which is calculated by formula (18). Due to the concentration of stresses in some areas, the pressure can exceed the estimated value.

In case of an erroneous mounting of the artificial acetabular fossa in revision hip joint replacement at 10°, the axis of the total force passes through the head center as before, however, the center of force application to the acetabular fossa will be shifted by 10°. Thus, the arc will be divided in a proportion not 90° / 90° but in a proportion of 100° / 80°. Then, for reasons of equality of moments acting on the acetabular fossa, the force will be divided in proportions of 80/180 and 100/180. That is, the force will be either $7 \cdot 80 / 180$ and $7 \cdot 100 / 180$ or 3.11 and 3.89 kg, with the length of the arcs being 2.79 and 3.49 cm respectively. Then, the additional pressure on the smaller arc will be $P_{add} = 38.90 / 2.79 = 13.90 \text{ N} / \text{cm}^2$, which is again substantially lower than the pressure produced by the weight, and it is about 4.2%. Note that in this case, the action of muscles increases the imbalance of pressures (it contributes to the additional increase in pressure, not to pressure reduction).

In case of inaccurate installation of the revision acetabulum (without plastic substitution of bone defects) into the defect connected not with a turn but with a displacement of the acetabulum up or down (in the direction at an angle of 45°), it is also important to take into account the location of the point of intersection of the forces muscles that are acting. When the acetabulum is set 5 mm upwards, into the defect of the acetabular roof, the balance of forces will change. At the same time, we believe that the forces of muscles did not change (patient's muscles do not adapt to a new position, although theoretically such an adaptation is possible). In this case, the angle is 14.2°. Then, the arc (it changes very slightly because of the displacement) will be divided in the following proportions: 3.01 and 3.27 cm at a total length of 6.28 cm. The force as before will continue to be divided proportionately: 3.36 and 3.64 kg. Accordingly, it gives a pressure in the lower section $36.4 / 3.01 = 10.21 \text{ N} / \text{cm}^2$, which is about 3.7% of the pressure created by body weight. In this case, however, the effect of pressure caused by muscles leads to a decrease in the imbalance of pressure, that is, it contributes to mitigation of the negative effects of pressure distribution caused by a patient's weight. Thus, the displacement of the acetabular component upwards reduces the effect of uneven pressure on the acetabulum. Accordingly, when displacing the component downwards, the effect will be the same, but with the opposite sign. That is, the effect of the pressure forces, which is caused by muscles, will increase the imbalance of pressure, which is caused by a patient's weight, by the same 3.7%. If one takes the most unfavorable case, i.e., the acetabulum is displaced downwards and set with a deviation from the nominal position at an angle of 10°, a part of muscle pressure will be about 8% of the total pressure due to a patient's weight.

Conclusions

In case of erroneous implantation of an artificial acetabulum with a deviation from the nominal position at an angle of more than 10°, the contact area of the component is reduced to less than

62%, which increases the pressure onto the bone tissue, contributes to implant destabilization, while the muscle action increases the imbalance of pressures (it contributes to an additional increase in pressure, and not pressure reduction).

1. In case of inaccurate installation of the revision acetabulum, without plastic displacement of bone defects, into the defect connected not with a turn, but with the displacement of the acetabulum up or down, the balance of forces changes.
2. When the implant acetabular component is displaced upwards due to the action of muscles, the effect of uneven pressure on the acetabulum, which is caused by the action of a patient's weight, is reduced.
3. When the implant acetabular component is displaced downward due to the action of muscles, the effect of uneven pressure onto the acetabulum, which is caused by a patient's weight, increases more.
4. When displacing the implant acetabular component downwards and setting it with a deviation from the nominal position, the role of pressure, which is caused by muscles, is a secondary factor.

DIAGNOSTICS AND TREATMENT OF PIGMENTED VILLONODULAR SYNOVITIS IN KNEE JOINT AT THE LATE STAGES OF THE DISEASES

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Introduction

Pigmented villonodular synovitis (PVNS) is a rare exudative-proliferative pseudotumor disease of unknown etiology, which affects the synovial membrane. In PVNS, no atypical cells are formed, although cytogenetic abnormalities have recently been proven. However, the presence of synovitis involves the inflammatory process. The PVNS etiology remains unclear. It is characterized by the deposition of hemosiderin in the synovial membrane. It is also uncertain whether this lesion of joints is a neoplasm or an inflammatory process. Previously published sources may include such PVNS related terms as xanthoma or giant cell tumor, myeloxanthoma, villous arthritis, benign synovioma, etc. The disease exists in two forms: a separate intra-articular node (local form of PVNS), and diffuse villous, villonodular pigmented alterations of the synovial membrane (diffuse form of PVNS). The disease, as a rule, affects only one joint, it is mostly the knee joint. Women are more susceptible to the disease. The age ranges from 16 to 45 years, but often PVNS affects the synovium in children and elderly patients.

The clinical picture of knee joint PVNS is diverse and depends on the type, form and stage of the lesion. The disease does not have pathognomonic symptoms and always requires a differential diagnosis with other diseases. A similar situation is with treatment: there are no unified treatment regimens and protocols in the world. The diffuse PVNS form has a high percentage of relapses.

Research objective: Studying and analyzing the modern diagnostic facilities and treatment possibilities for pigmented villonodular synovitis of the knee joint at the late stages of the disease.

Materials and methods

36 patients with a pathologistologically verified diagnosis of pigmented villonodular sinusitis of the knee joint (PVNS) were examined and operated in the Department of joint diseases in adults of the State Institution “Institute of Traumatology and Orthopedics of Ukraine” under National Academy of Medical Sciences of Ukraine (NAMN), Kiev, Ukraine, within a period of 2011 to 2017. The two forms of the disease exist: diffuse and local. We treated 26 patients with a diffuse form of PVNS and 10 patients with a local form of PVNS, with 6 patients with late stage of PVNS of the knee joint among them. Most patients are young people, mostly female, with an average age of 30 years. The duration of the disease was within the range of 3 to 10 years. At the preoperative stage, all the patients were treated conservatively at the place of residence, some of them were also operated in our department and in other medical institutions as well. The patients were examined clinically, laboratory and instrumentally. The diagnostic data provided by X-ray, ultrasound, and MRI were evaluated retrospectively, taking into account intraoperative data (in some cases arthroscopy) and pathomorphology data.

Research findings

The patients complained of persistent pain and discomfort, periodic nocturnal pain, severe edema, and limitation of knee movements, which was observed in all the patients examined.

When carrying out a clinical examination, the signs characteristic for the synovitis of the knee joint were observed. Palpatory soreness was determined along the joint gap and in the area of the patellar and femoral part of the knee joint, in the area of the upper turn wherein the tumor-like mass of doughy texture was palpated. No signs of local hyperemia are observed. The range of motions is much restricted in comparison to that of the contralateral limb: flexion and extension contracture of the knee.

Pre-operative differential diagnostics of pigmented villonodular synovitis should be done with giant cell tumor, synovial sarcoma, synovioma, rheumatoid arthritis, and synovial chondromatosis.

As a rule, standard X-ray images show alterations characteristic of gonarthrosis, however, the images may be uninformative enough about the disease itself. Ultrasound examination is also uninformative. The most informative visual diagnostic method is MRI that makes it possible to evaluate the size, localization, and extent of the joint lesion.

Synovectomy and the total knee joint replacement are leading methods of treatment for PVNS of the knee joint at late stages. As a rule, these patients have substantial alterations of all the intra-articular structures. Some of them are patients with a relapsing disease.

All the patients underwent synovectomy of the knee joint. 4 out of 6 patients underwent the total knee joint replacement. The following alterations were detected intraoperatively: substantial growth and tumor-like mass of the synovial membrane; thinning and defects of the articular cartilage; and sometimes defects of the processes and the patella, which were caused by the ingrowth of the synovial membrane altered by the disease. The alterations as follows are characteristic for the synovial membrane in PVNS: villous and nodular proliferations with a characteristic reddish brown color caused by the presence of hemosiderin and lipids. The pigmentation color varied from yellow to dark brown, depending on the frequency and volume of hemorrhages from fragile newly formed blood vessels. All the patients underwent one stage or stage-by-stage subtotal synovectomy of the knee joint; 4 patients underwent the total knee joint replacement. Removed intraoperatively, the material was sent to a pathomorphological examination.

The maximum follow-up period for this group of patients was 5 years, and the minimum follow-up period was 4 months. Long-term results are considered good.

Conclusions

MRI is the most informative diagnostic methods among non-invasive instrumental methods of examination; it allows the most accurate evaluation of the degree of joint alteration and spread of the disease. MRI should be done even if a standard X-ray image shows alterations that correspond to stage III-IV gonarthrosis.

Subtotal synovectomy and the total knee joint replacement are the leading method of treatment for pigmented villonodular synovitis of the knee joint in late stages of the disease.

Patients with PVNS require dynamic follow-up with periodic MRI examination to rule out the possibility of recurrence.

After the pathomorphological verification of the PVNS diagnosis, the patients with the recurrence of PVNS of the knee joint require additional follow-up and consultation of the oncoorthopedist to consider the expediency of further radiotherapy.

PARTICULARITIES OF CLINICAL EXAMINATION OF ADULT PATIENTS WITH CONGENITAL HIP DISLOCATION (CHD)

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Introduction

Congenital hip dislocation (CHD) is a congenital malformation of the hip joint due to its improper development, which leads to dislocation of the femoral head. This is the most severe form of hip dysplasia. The CHD incidence is more than 3% of the total hip joint diseases. According to the Register of Joint Replacements in Norway, congenital hip dislocation is found in 10% dysplasia cases. The social significance of this disease is determined by its development in young patients of working age, with the disease progressing steadily and leading to virtually a fatal disability. To date, the main method of treating congenital hypertrophy in adults is the total hip joint replacement. This surgical treatment method requires careful preoperative planning, as to implement it, uneasy issues should be solved, and which are associated with the anatomical particularities as follows: underdeveloped acetabular fossa; shallow, saucer-shaped acetabulum; the acetabular roof is almost absent. In the preoperative examination of patients, the following changes are also observed in the proximal femur: altered congruence of the articular surfaces; the femoral head is displaced cranially in relation to the acetabulum. Hip joint replacement in patients with congenital hip dislocation (Crowe Type III and IV) is a complicated high-tech surgical intervention. The complexity of the surgical intervention in adult patients with CHD is related not only to the anatomical features (altered acetabular fossa, changes in the ratio of the femoral head and the acetabulum, changes in the proximal end of the femur and the femoral head), but also to alteration of the biomechanics in the hip joint. This is stated in the academic literature concerning orthopedic treatment of CHD in adult patients, and the results are considerably inferior to the results of the primary standard hip replacement. According to literature sources

(Tykhilov R.M., 2014), the total hip replacement in such complicated cases is accompanied by a high number of unsatisfactory results (about 20%). To select the tactics of the hip joint replacement, it is important to differentiate the changes in the hip joint, namely, the ratio of the femoral head relative to the acetabulum. In the hip joint replacement for congenital hip distortion, uncertain questions remain concerning the position of the acetabular implant component, the use of bone plastics for the acetabulum roof, and the adjustment of the implant head.

Research objective: Studying and investigating the particularities of clinical examination of adult patients with congenital hip dislocation.

Materials and methods

The work is underlied by the analysis of the clinical examination of 11 adult patients with type IV congenital hip dislocation according to Crowe J.F. classification; the patients underwent 12 total hip joint replacements in the Department of Joint Diseases of the State Institution "Institute of Traumatology and Orthopedics of Ukraine" under National Academy of Medical Sciences of Ukraine (NAMN), Kiev, Ukraine. The patients were distributed by sex: females – 8; males - 3. The age of operated patients ranged from 15 to 57 years; and an average age was 37.4 years. All patients underwent pre-operative clinical, instrumental, and laboratory examination. When carrying out the surgery, we used implants with cementless fixation type for components in 8 cases; the hybrid type of fixation of components in 3 cases; and cemented fixation type for implant component in 1 case. The maximum follow-up time for patients was 10 years, and the minimum follow-up time for patients was 1 year.

Research findings

All the patients examined preoperatively had a shortening of the lower limb, restriction of range of motions in the hip joint, disturbance of topographic correlations in the area of the hip joint. The majority of the symptoms common to coxarthrosis were positive: Thomas seizure test, trochanteric irritation symptoms, Kalchschmidt tests, etc. The shortening of the lower limbs varied from 3.5 to 7 cm. In the postoperative period, the length of the limbs was equal. The "piston" symptom and the "anvil" test, which were negative in all cases, were used among the symptoms additionally in the postoperative period.

Conclusions

We studied clinical particularities of adult patients with congenital hip dislocation. It was studied and tested which tests and symptoms helped to diagnose hip joint dysplasia (in particular, the congenital hip dislocation). The authenticity of "classical" tests and "new" diagnostic tests of congenital hip dislocation were checked. It was established that Kalchschmidt hip joint dysplasia tests were not inferior in terms of the diagnostic value of "classical" tests, such as Duchenne-Trendelenburg symptom, etc. In the postoperative period, the recovery of anatomical landmarks, such as the Roser-Nelaton line (Kuslitz line), the Bryant triangle, the Shoemaker line, transtrochanteric line, and the limb length indicate the installation of the acetabular implant component into the "true" acetabulum, which will further accelerate the recovery and social adaptation of the patients operated. The "anvil" test and the "piston" symptom are mandatory and valid clinical symptoms that characterize the implant stability in control examinations. The "anvil" test, or rather its negative result in the patient, may indicate not only implantation and "ingrowing" of the surrounding tissues into the implant components, but also the rebuilding of the used bone autograft of the acetabulum "roof". The negative "piston" symptom indicates the stability of the implant components and also the restoration of the force and the tone of the muscles involved in the motions of the hip joint.

TACTICS OF SURGICAL TREATMENT OF RHEUMATOID ARTHRITIS

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Introduction

Rheumatoid arthritis (RA) is a chronic disease that eventually leads to disability, which is caused mainly by destruction of the joints of the upper and lower extremities. The prevalence of rheumatoid arthritis, its chronic progressive course, the absence of pathogenetic therapy, the affection of the most able-bodied population, and high disability indicate an important medical and social significance of the treatment of patients with RA.

Research objective: Improving the quality of life and restoring the function of the joints, relieving pain and preventing further deterioration of the general condition.

Materials and methods

For patients with RA, a large number of surgical techniques are currently available. Their use depends on the stage and activity of the pathological process. The most common and efficient treatment methods are arthroscopic or open synovectomy, arthrodesis, joint replacement and operations on soft tissues. Myothenoplasty surgeries on joints and soft tissues, and replacements of the joint of hand are used to restore the characteristic hand deformities.

Research findings

Today, the role of surgical treatment in the general therapy of rheumatoid arthritis is reviewed and, along with therapeutic treatment, it may be used at the early stages, before the appearance of destructive changes in the joints and the tendon-ligament apparatus. Pain, functional failure, further loss of quality of life, and social disadaptation are the main indications for surgical reconstruction of the joints. Polyarticularity of the inflammatory process makes it difficult to determine the term of surgical intervention. It is indisputable that at early stage, surgical treatment should be initiated in the most affected joints. At later stages of polyarticular lesions, we proved the need to restore the biomechanical chain of the limb of the most significant biomechanical joint. On the upper limb, this is the elbow joint; on the lower limb, this is the hip joint. Conservative treatment involving a combination of nonsteroidal anti-inflammatory drugs, hormone therapy, basic drugs, and biological therapy is a prerequisite for controlling the activity of the general inflammatory process, and as a result, obtaining positive results of surgical treatment. The decision about orthopedic intervention should be taken by an interdisciplinary team that includes rheumatologists and orthopedic surgeons experienced in RA surgery. Progression of the disease and pharmacological treatment options should be taken into account when establishing the orthopedic protocol of intervention.

The functional result of surgical treatment also depends on following the programme of post-operative rehabilitation.

Conclusions

The basic principles of orthopedic treatment of the RA are the earliest possible initiation of treatment, continuity of approaches in rheumatologists and orthopedists, permanent active rehabilitation, which will allow this complicated category of patients to preserve the possibility of self-service and working capacity for a long time.

JOINT HIP REPLACEMENT IN FEMORAL NECK FRACTURES

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Introduction

The proximal femoral fractures are about 30% of all skeletal injuries. The femoral neck fracture incidence is 45% of all injuries of the proximal femur and 6-13% of all injuries of the limb bones. The patients aged 60 years and older prevailed in the group of injured persons. Hip joint replacement is indicated to patients with femoral neck fracture among all possible treatment methods, taking into account the nature of the fracture and the age group of the patients

Research objective: Evaluating the results of the hip joint replacement in patients with femoral neck fracture.

Materials and methods

In November 2015, hip joint replacements started in two traumatological departments of Professor O.I. Meshchaninova Kharkov Municipal University Hospital of Emergency Medical Aid No. 4. The hip joint replacement was carried out in 70 patients for this period of time (18 months) in the departments. Men and women were 21 and 49, respectively, with an average age of 67.7 years. Cementless hip joint replacement was carried out in 31 cases (average age was 59.65 years), cemented hip joint replacement was carried out in 38 cases (average age was 72.43 years), and a hybrid hip joint replacement was carried out in 1 case (in patient aged 66 years). In all cases, the total hip joint replacement is used. The postoperative period and rehabilitation were carried out according to standard regimens; the restoration of musculoskeletal function began as early as 3 or 5 days with full load on the limb operated. The full load on the operated limb was limited to 3 months after the surgery after the cementless hip joint replacement in patients with a high body mass index. The treatment results were evaluated by questioning the patients about the availability and the degree of manifestation of such criteria as pain, stiffness in the joint and functional capacity (professional ability and activities of daily living).

Research findings

Results and conclusions. The treatment results were evaluated in 66 patients within the period of 1 to 18 months (the term was less than 1 month after the surgery in 3 patients; there was a fatal outcome in case in the early postoperative period due to a pulmonary artery thrombembolia). The hip dislocation was in 1 patient (1.5%) in 2 months after the surgery, with its cause being a gross violation of the restrictive measures by the patient. The hip dislocation was removed and subsequently it did not repeat. An early profound infectious complication was diagnosed in 2 cases (3%), which resulted in revision, debridement, and drainage within the first 2 weeks, and a prolonged antibiotic therapy was administered. Recuperation was achieved in one case. The infectious process became chronic para-implant infection with instability of the components of the implant in the second patient (1.5%). This patient underwent revision, necrotomy, removal of the implant, and replacement of the defect of the femoral head with a cemented spacer with antibiotics. A substantial limitation of motions in the hip joint was determined in 3 months after the surgery in one case (1.5%), which was due to a massive heterotopic ossification in the hip joint region. The patient was administered a rehabilitation course with a moderate positive dynamics, however, some functional disorders could not be eliminated. The indicators of pain, stiffness, and functional results were satisfactory; activities of daily living and

professional ability in able-bodied patients have been fully recuperated in all the cases, except the last 2 complications. Thus, the results of the hip joint replacement are positive in 64 from 66 patients (97%).

RECONSTRUCTION OF THE POSTERIOR CRUCIATE LIGAMENT OF THE KNEE JOINT AS PER ONLAY TECHNIQUE

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Abstract

Injury of the posterior cruciate ligament of the knee joint is one of the most serious injuries of the capsular ligament apparatus of the knee joint. These injuries are much less common than tears of the anterior cruciate ligament; and their incidence is within the range of 3 to 20% of all the knee joint injuries.

Due to diagnostic difficulties, the posterior cruciate ligament injuries are often not diagnosed, which leads to the development of posterior instability and secondary changes in the knee joint. If treatment is not provided, deforming arthrosis of the knee joint progresses in 8-36% of cases. Thus, according to numerous domestic and foreign academic publications on the subject, inadequate tactics of treatment for injuries of the capsular ligament apparatus in 47-60% of cases leads to the development of various forms and degrees of instability of the knee joint.

Research objective: Research objective: Improving the treatment of patients with injuries of the posterior cruciate ligament of the knee joint by using arthroscopic reconstruction as per "Onlay" technique.

Materials and methods

56 patients were treated in regional hospital of Feldkirch (Austria) with injuries of the posterior cruciate ligament (PCL) from October 2007 to September 2013, with 44 (78.57%) men and 12 (21.43%) women among them. In 32 (57.14%) cases, isolated ruptures of the PCL were observed, and in 24 (42.86%) cases combined injuries were observed.

PCL injuries occurred as a result of an athletic injury in 28 (50%) cases. Playing football and skiing are the sports that most often cause PCL injury. The PCL injury was due to a traffic accident in 17 (30.36%) cases. PCL ruptures occurred due to other reasons in 11 (19.64%) cases. PCL rupture was diagnosed during clinical examination in all patients by using X-ray images and magnetic resonance tomography.

Conclusions

The objective of the reconstruction of the posterior cruciate ligament is the restoration of the function of the knee joint. At the same time, there are numerous treatment methods (conservative and operative), experimental concepts, and recommendations (ESSKA) for the optimal elimination of backward

instability. Biomechanical results explain good stability of anatomical reconstruction. The arthroscopic “all inside” technique with Retro Drill® may be recommended as a valuable alternative to PCL reconstruction. The subjective and objective results averaged over the terms appear to be promising: subjective satisfaction, objective stability, a return to sports, and the absence of arthritic degeneration. The number of complications is quite acceptable. It is necessary, however, to point out the need for special protection of neuromuscular structures. The data of this study are based on a small and heterogeneous number of patients with a relatively high percentage of patients who left the study in the absence of a control group, and therefore only careful interpretation of the results is acceptable.

FUNCTIONAL MEDICAL REHABILITATION IN PROFESSIONAL SPORT

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The problem relevance is associated with the high demands on functional rehabilitation of athletes after injuries and surgical treatment, which will improve the quality of life and also provide an opportunity to return to the full implementation of professional sport activities.

Research objective: Improving the quality of medical rehabilitation in professional athletes on the basis of the principles of consistency and functionality.

Any rehabilitation must be safe and functional. This may be achieved provided that the functioning of the injured joint or limb is understood not as a separate anatomical unit, but as an integral part of the musculoskeletal system and, if we take it more broadly, the human biological system. First of all, it is important for us not only to restore the function of a specific joint in a narrow sense, but also to restore support and gait functions in a wider sense, and which is very important, to restore a high-quality well-coordinated work of the entire musculoskeletal system.

We know that everything in the body is regulated by the central nervous system (CNS) as a reflex feedback. No muscle and ligament will change its tone without the CNS, even post-traumatic adaptation changes are a process also regulated by the CNS.

We propose to solve this problem by studying the human body through a synergetic approach (synergetics, a science about systems), cybernetic control models, mathematical analysis, and information theory (cybernetics and applied neurophysiology), as well as taking into account the laws of interaction of the system with gravity (posturology science).

Research objective: Using the regulation mechanisms inherent to the human body. Then, our impact itself will be curative along with the reaction of the human regulatory systems to the impact, which will lead to an improvement in the stability and functionality of the entire musculoskeletal system.

All practical work is based on preliminary functional testing to understand what functional structures need to be corrected and in what way. We do not impose our opinion on the system; all the answers to all the questions are within the system of the patient himself. It makes our work with the patient purely individual, systemic, diverse, safe and effective.

This approach makes it possible to work with a person as an integral system, taking into account the diversity of hierarchical relationships, through the control systems of the person himself.

As a substrate for work, we propose to use the system of neural regulation, the system of gravitational adaptation, and the system of cranio-sacral and biodynamic interactions, the controlling elements of motor activity, as well as psycho-somatic and somatopsychic connections. We create conditions for the fulfillment of our own balance in the system due to the mechanisms of self-correction inherent to the human body.

At the same time, the changes, which occurred in the body, are achieved not by our external influences, but due to our own corrective reaction of regulatory systems of the body. In fact, through various types and methods of intervention in the system, including manual impact, we change information received from the peripheral proprioceptors, thus provoking the central nervous system to produce a correction impulse, which is the Objective of this research work, and it is the source of all changes. Change of function due to own regulatory mechanisms will be always supported by these regulatory mechanisms further on.

It is fundamentally important to work in synergy with the processes occurring in the system. It is quite logical that attempts of active and passive impact in the form of exercise therapy and mobilization can often be aggressive for the system, and the system will not always respond to the processes with an increase in functionality.

The work we carried out is experimental, but it is conditioned anatomically and physiologically. The first results of work with professional footballers, track and field athletes, and krosfit athletes showed its efficiency, including efficiency after surgical treatment. In addition, it is pertinent to note that this approach makes it possible both to rehabilitate after injuries and also to work on increasing the overall functionality of athletes, which improves their endurance and reduces the risk of functional injuries.

Therefore, we recommend using a systematic functional approach in matters of medical rehabilitation.

OUR EXPERIENCE IN CLOSED INTRAMEDULLAR OSTEOSYNTHESIS OF FRACTURES OF THE PROXIMAL HUMERUS

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Key words: Fracture, humerus, closed reduction of a fractured bone, intramedullar osteosynthesis.

Introduction

Currently, intramedullary osteosynthesis is considered the gold standard of the treatment of diaphyseal fractures. The biomechanical particularities of the method, low invasiveness with closed reduction and correct technical implementation make it possible to achieve a fast predicted recovery of the function of the injured segment with the minimum number of complications.

Relevance

Carrying out an open reduction in extracortical osteosynthesis is associated with the risk of infectious complications, devascularization of bone fragments, the elimination of the primary hematoma, and the subsequent disturbance of fracture consolidation, especially in complex multifragment fractures.

Materials and methods

In 2016, we introduced the method of closed reduction and intramedullary osteosynthesis of proximal humeral fractures. Closed fracture reduction was achieved manually or by using a wire distractor assembled from the components of the Ilizarov apparatus. The surgeries were performed according to the original technique developed in clinic of V.D. Chalkin Ural Research and Development Institute of Traumatology and Orthopedics.

Research findings and discussion

14 patients with proximal humeral fractures were treated in the department of traumatology and polytrauma of Municipal University Hospital of Urgent and Emergency Medical Aid, Zaporozhye, for the period from 2016 to 2017. They were operated by using the method of closed intramedullary osteosynthesis with blocking.

Surgeries were performed within the periods from 2 to 21 days after injury. Made by Interlock TT and ChM manufacturers, the cannulated intramedullary rods were used as a fixtures, with their diameters being of 7, 8, and 9 mm and lengths being within the range of 180 to 240 mm.

In 8 patients (57% of the total number of patients), the fracture was reduced by traction and rotation along the axis of the injured limb, and by controlling the proximal part with a joystick.

In 6 patients (43% of the total number of patients), the method of closed reduction of humeral fractures was used, using a swire distractor. All the surgeries were performed under control of intraoperative X-ray.

Closed reduction and blocked intramedullary osteosynthesis (BIOS) was performed in 14 patients (100%).

The average blood loss was within the range of 50 to 80 ml.

Active rehabilitation began in 2 or 3 days after the surgery. No infectious complications were observed in the patients operated. The average hospital stay was within a period of 4 to 5 days.

Conclusions

The method of closed intramedullary osteosynthesis of proximal humeral fractures is available for widespread practical use. While retaining all the advantages of minimally invasive surgery, the method avoids open reduction without requiring surgical access to fracture fragments. This makes it possible to reduce the number of postoperative complications, to reduce the time of hospital stay, and to reduce the time of postoperative rehabilitation. Using a wire distractor allows the surgeon to apply greater efforts when reducing the fracture and to perform the operation without an assistant.

NEUROORTOPEDIC ASPECTS OF SURGICAL TREATMENT OF SPINE TUMORS

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Key words: Spine, metastasis, transpedicular system, laminectomy, stabilization, decompression.

Epidemiology

Metastatic lesions of the spine and spinal cord are secondary malignant neoplasms and are much more common than the primary tumors of this localization. Metastatic tumors are found in 96% of cases,

while primary tumors are found in 4% in cases. Spinal metastases are up to 70% of all metastatic lesions of the skeleton.

Relevance

Approximately 5% of patients with a generalized form of cancer have spinal cord compression, with a half of them being the first manifestation of the disease. The associated pain syndrome and neurological deficiency lead to a pronounced limitation of patient's motor activity and a decrease in the quality of life.

Diagnostics

All patients with metastatic spinal lesions are clinically examined with:

- standard spine X-ray in two projections;
- MRI of the affected spine part in the sagittal and frontal projections;
- CT scan of the affected segment;
- assessment of neurological status in the pre-and postoperative period.

Surgical treatment

The surgical treatment strategy for each patient is developed by the board of doctors, including oncologists, neurologists and orthopedists. Surgical treatment means the total removal of the tumor. Taking into account the anatomical particularities, the operations in patients with metastatic spinal lesions is considered radical conditionally and almost always the patients require additional treatment. When performing decompressing and stabilizing surgeries through a posterior access, a laminectomy is performed, which is followed by stabilization with a transpedicular system. If the front access is used, the body is resected and the defect is replaced with an implant or bone cement, which is followed by stabilization.

Research findings

The result of surgical treatment is manifested in the relief of pain and regression of neurological symptoms. Decompression of the spinal cord has a positive effect on the state of trophism. The high stability of the transpedicular systems allows the activation of patients in the early postoperative period.

Conclusions

The modern approach to surgery for secondary tumors of the spinal cord, both malignant and metastatic, implies the total removal of the tumor under certain conditions and full restoration of the spinal support ability, which is followed by radiation therapy and/or chemotherapy.

Decompressing and stabilizing surgeries, being a palliative intervention, greatly improve the quality of life of doomed patients due to elimination of spinal cord compression and instability of the spine, thus prolonging their active life.

OUR EXPERIENCE IN THE TOTAL JOINT HIP REPLACEMENT IN FEMORAL NECK FRACTURES

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Research objective: Analyzing the results of surgical treatment, i.e. the total hip joint replacement carried out in orthopedic department of Municipal University Hospital of Urgent and Emergency Medical Aid, Zaporozhye (KUGKBE and SMP).

Materials and methods

The femoral neck fractures are described in academic literature on the subject as a real epidemic: in 1990 about 1.3 million fractures were registered worldwide, and the number of femoral neck fractures expected in 2050 is 4.5 million (K. Heithoff, 1990; Koval, K., 1994).

Injuries and diseases of the musculoskeletal system rank second among the causes of temporary disability, and they rank third among the causes of disability and mortality of the population (N. Kornilov and K. Shapiro, 1993).

K. Koval and J. Zuckerman (1994) note that among older people with femoral neck fractures, mortality ranges from 14 to 36% within the first year. Moreover, patients with the femoral neck fractures become disabled in 20–50% of cases. It testifies a huge social significance of this problem.

The only modern reasonable and most efficient treatment for hip joint injuries is the total hip joint replacement. The surgical intervention relieves patients from pain, claudication, false fracture settings and shortening of the limb, with the joint motion restored. The hip joint replacement objective is to do the joint painless and movable once again, which will allow the patient to get back to his life. The implant service life is on average 15-20 years, and in many cases, patients use them even for 30 years. When the implant is worn out, it should be replaced with a new one.

Surgical treatment of patients with injuries of the femoral neck and head should be used according to strict indications, taking into account performance status, the degree of joint deformity, patient's age, and concomitant diseases, if any.

A femoral neck fracture is an injury that causes disturbance of the integrity of the femoral neck, the thinnest part that connects the body of the femur with the femoral head.

The femoral neck fracture incidence is 6% of all types of fractures. Statistics show that most often the femoral neck fracture is pathological and results from a minor injury in a person with osteoporosis. The lesion is most common in postmenopausal women. 90% of cases occur in people aged 65 years and older.

Research finding and discussion

142 surgeries of hip joint replacement were performed over the past 2 years in the orthopedic department of the Municipal University Hospital of the city of Zaporozhye, among them 86 urgent surgeries and 64 planned surgeries. Patients aged 27 to 96 years.

When selecting surgical treatment, ETBS2 Motor Sich and ITO Motor Sich implants were used, as well as Zimmer, Trabecular Metal, Trilogy, CPT, and AvenirMuller implants. Made by various companies, each implant component has its own design particularities, requires a special surgical technique, etc. The materials the modern joint implants are made of exhibit high resistance and good survival in the human body.

Preoperative preparation and planning is the most important stage that determines the success of the surgical treatment. In urgent cases, it is difficult to carry out the full preoperative preparation. And yet,

the patient must be examined by a therapist, anesthesiologist, and other specialists in accordance with the concomitant diseases, if any.

Blood and urine should be taken for tests; ultrasound of blood vessels of the limbs and fibrogastroduodenoscopy (FGDS) should be done as well as evaluation by related specialists as we pay attention to the functional state of the patient. Preoperative preparation includes training with an instructor of exercise therapy, training to walk with walkers/crutches, breathing exercises, strengthening muscles of hands, back and legs, which in turn is the prevention of bed sores and venous congestion in the small and large circulations, the prevention of thromboembolic complications and, according to our observations, it accelerates the process of rehabilitation in the early postoperative period.

In the total hip joint replacement, we process the surgery site and wound cavity by using pulse-lavage with 800 ml of 0.05% chlorhexidine solution in wound closure; then we treat the surgery site with 200 ml of Betadine (Povidone-iodine solution). In osteoporosis, the acetabulum treatment should be attenuated with milling cutters, which is followed by strengthening its walls with autografts taken from the remote femoral head. In the presence of metal structures previously used to fix femoral neck fractures, the first step was to remove this structure and then install the implant. In the presence of bone defects remaining after the removal of the metal structure, osteoplasty was performed.

In the postoperative period, pulmonary embolism was prevented by administering low molecular weight fraxiparine (flenox 0.4) and by applying elastic bandage from the fingertips to the upper third of the thigh.

In the postoperative period, pulmonary embolism was prevented by administering low molecular weight fraxiparine (flenox 0.4) and by applying elastic bandage from the fingertips to the upper third of the thigh. Differentiated approach to each case gives positive results. All the patients were activated at the second or third day after surgery, with the patient walking with the help of a walker, and the metered load on the operated limb permitted in 3 days after the surgery.

The patients were discharged from hospital in 10-12 days after the surgery. Rehabilitation activities should be continued, strictly following the recommendations of the surgeon who operated on the patient. If necessary, admission to rehabilitation center is possible for rehabilitation under the guidance of rehabilitation specialists. Physical activity on the limb operated should be limited within a period of 6 to 8 weeks after the surgery, with the use of an additional support recommended for this time.

Conclusions

Hip joint replacement is an accurate surgical intervention; its objective is to do the joint painless and movable once again, which will allow the patient to get back to his life. New materials were developed due to technical progress, which may replace an injured joint with an artificial one. Just like a normal hip joint, an artificial one consists of a round head and a concave acetabular fossa wherein the head rotates, allowing for normal range of motion. An appropriate implant is selected for each individual case.

PRIMARY HIP JOINT REPLACEMENT IN TROCHANTERIC FRACTURES IN PERSONS OF ELDERLY AND SENILE AGE

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Introduction

In trochanteric fractures, various versions of the extracortical or intramedullary osteosynthesis are used for stabilization of the bone fragments and early mobilization of patients. However, in spite of the availability of existing modern metal constructions, as well as technologies of minimally invasive osteosynthesis, the frequency of unsatisfactory results and complications after the implementation of osteosynthesis in transtrochanteric fractures, according to various authors, reaches 20% (Vorontsova T.A. et al., 2016; Bottai V et al., 2014).

The most widespread complication - up to 20% - is the secondary displacement of fragments after reduction and internal osteosynthesis due to the early loading of the limb operated. Infectious complications of the wound process are observed after the osteosynthesis of trochanteric fractures Bryant triangle, the use of osteosynthesis is limited to the presence of substantial degenerative changes in the hip joint on the injury side.

In recent years, the primary implants of the hip joint has considered as an alternative to osteosynthesis in trochanteric fractures of the femur in persons of elderly and senile age. However, implantation of the femoral implant component is performed in non-standard conditions due to the destruction of the proximal femoral metaphysis and muscles that have to provide the motor function, and, which is most important, the stability of the hip joint. It determines the necessity of a detailed planning of the surgery: first of all, the peculiarities of the primary stable fixation of the implant stem, taking into account the nature of the fracture of the proximal femur, as well as the individual physical capabilities of the patient.

Research objective: Research objective: Substantiating the use of arthroplasty for trochanteric femoral fractures in persons of elderly and senile age, and technical particularities of the implantation of the implant femoral component.

Materials and methods

The study group included 38 patients aged 72 to 88 years (mean age $76,4 \pm 2,1$ years) operated within the period of 2012 to 2016 in the departments of the Research and Development Institute of Traumatology and Orthopedics under M. Gorky Donetsk National University, Liman, Ukrain, and in clinics of Medical Faculty of Uzhgorod National University.

According to the AO classification, 34 patients had transtrochanteric femoral fractures: simple fracture (31-A1) in 13 patients; comminuted fracture (31-A2) in 21 patients. Four patients were operated for comminuted intertrochanteric fractures (31-A3). The terms of admission in traumatology departments are within the range of 1 to 3 days after injury. The terms of the primary arthroplasty of the hip joint are within the range of 3 to 9 days after the injury. Hemarthroscopy was performed with unipolar implants in 34 patients. In 32 of them, cemented fixation of implants was used: with 27 patients having a standard stem and 5 patients having an elongated stem among them. Cemented revision stems were implanted in 2 patients; the total arthroplasty with cemented fixation of both implant components was carried out in 4 patients.

An argument in favor of the use of arthroplasty was the attempt to activate quickly patients. The main factors that determined the choice of surgical tactics were the individual particularities of the general condition of patients, which made impossible the early restoration of the supporting function of the

damaged limb when using internal osteosynthesis. These factors included the degree of osteoporosis of the proximal femur. According to the densitometry data in the patients examined, the average value of the T-index was 3.2 ± 0.84 (severe osteoporosis). Physical activity before injury was limited in the 32 patients by both a concomitant somatic pathology and the excessive body weight (the body mass index ranged from 26 to 35 (the average value was 30.6 ± 3.1)).

In 4 patients, the use of primary total arthroplasty for trochanteric fractures was determined by the severe degenerative changes in the hip joint.

Research findings

All the patients had satisfactory initial fixation of the implant femoral component in the proximal femur. In case of marked involitional osteoporosis and in conditions of limited physical abilities, primary arthroplasty made it possible to provide early mobilization, support and motor functions of the injured limb in all the patients operated. We did not observe the complications associated with the reconstruction of the proximal femur and the implantation of implants. We did not offer that the patients limit load onto the operated limb while standing and walking from the first days after the surgery. The particularities of the regenerative period of the treatment and of the rehabilitation measures were determined by the general somatic state of patients. The patients were discharged for outpatient treatment on the 10th - 12th day after the surgery. On the day of discharge from hospital, all the patients could move with a walker or two crutches without limiting the load onto the operated limb. The technical particularities of the implantation of the implant stem depended on the nature of the trochanteric fracture, which was determined as per the AO classification (class 31-A). In biomechanical terms, it is very important to restore the medial wall of the femur at the level of the lesser trochanter and below it, along which the maximum load is distributed from the implanted implant stem. Depending on the location of the fragments of the greater trochanter and the subtrochanteric area, the fixation was done by the cerclage wire in the form of circular clamps. When carrying out the reduction and provision fixation of the fragments, we consider it impossible to cut off the muscles that are attached to the trochanter area, as they, in the future, should ensure the stability of the artificial joint. To replace the defect of the intertrochanteric area, we cut off an annular fragment of the basal part of the neck from the removed proximal fragment with a saw, which the annular fragment including about 2 cm of the Adams Arc. Upon destruction of less than 5 cm, including the location of the lesser trochanter, it is possible to use stems of standard size. When the destruction is larger, implants with elongated stems were used for cemented fixation. The duration of surgical interventions ranged from 50 minutes to 1 hour and 20 minutes. The average intraoperative blood loss was 260 ± 60 ml. Moderate postoperative anemia did not affect the process of gradual recovery of motor activity in patients.

Conclusions

1. The results of joint replacement in trochanteric femoral fractures evidence the expediency of this type of surgical intervention in persons of elderly and senile age in the presence of marked osteoporosis and limited physical abilities to restore static and dynamic function.
2. Reconstruction of the proximal femur makes it possible to implant the femoral implant component by using bone cement and an individual selection of the stem length.

3. Reconstruction of the proximal femur with the preservation of the muscles attached to the greater trochanter ensures the stability of the hip joint and conditions for the reparative process around the fragments that form the trochanter area.

SURGICAL TREATMENT OF GUNSHOT WOUNDS OF THE LIMBS IN TRAUMATOLOGICAL DEPARTMENT

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Introduction

The development of surgical methods to treat battlefield injuries depends largely on the injury nature. In recent decades, the proportion of mine-blast and missile wounds has increased substantially along with gunshot wounds, which is accompanied by massive destruction of soft tissues and the human skeleton. Analysis of the nature of injuries has shown the need to find new methods for wound treatment. We focused on the use of VAC systems at various stages of treatment of gunshot and mine-blast wounds.

Research objective: Improving the results of treatment of patients with gunshot wounds to the extremities by using modern surgical methods.

Materials and methods

A retrospective analysis of the results of surgical treatment of 42 patients with gunshot wounds to the extremities received within the period from 2014 to 2016 was carried out in the Department of Traumatology of Zaporozhye Regional University Hospital. Among them: gunshot wounds to the soft tissues of the extremities were 54.8%; gunshot wounds with injury of the bones of the extremities were 26.2%; and mine-blast wounds were 19%. All the patients underwent primary surgical debridement at early stages according to approved protocols; if injured persons were admitted after the primary surgical debridement provided, second look surgery was carried out, and then repeated surgical debridement was carried out every 24-48 hours until the wound was cleaned. Fractures were fixed with external fixation devices. In all the cases, vacuum-assisted closure of wounds (VAC therapy) was used to close the extensive soft-tissue defects. If wound selfhealing was impossible, various methods were used to close the defects after wound cleansing if no signs of infection were present.

Research findings and discussion

In all the cases, the affected limbs were saved. The following complications occurred in the treatment process in 6 patients (14.2%): lamellar dissection was in 3 (7%) cases; trophic wounds of the damaged area were in 2 (4.8%) cases; and non-union was in 1 (2.4%) case. Thus, in 85.8% of cases a positive result of treatment was obtained, and with no complications developed.

Conclusions

Using modern methods of surgical treatment (the use of VAC therapy) in persons with gunshot wounds to the extremities in traumatology department made it possible to achieve positive results in most cases (85.8%) and minimize complications, which in turn made it possible to carry out early physical and social patient rehabilitation. Thus, compliance with the protocols of management of the injured

persons with gunshot wounds in combination with the use of modern treatment technologies makes it possible to conduct early full physical and social rehabilitation of patients.

ASSESSMENT OF THE RESULTS OF SURGICAL TREATMENT OF FRACTURES OF PROXIMAL METAPHYSIS OF THE FEMUR

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Introduction

Treatment of fractures of the proximal femur is one of the relevant problems of modern traumatology so far. The number of persons who suffered from this pathology is increasing every year. Fractures of the proximal femur are more common in elderly patients suffering osteoporosis; and the incidence of the fractures is 3-4 times higher in women. About 90% of transtrochanteric fractures in elderly persons are the result of their falling on the side from their own height.

The proximal femoral fractures in elderly persons are a complex medical and social problem that requires immediate action of physicians to avoid aggravation of all somatic diseases that the patient might have, as 96.7% of patients with proximal femoral fractures have comorbidities. After trauma, 44.8% of patients have a rapid decompensation of already existing somatic diseases requiring medical correction, and the probability of death is very high among them (within the range of 25 to 44%).

Research objective: Improving the results of treatment of patients with the proximal femoral fractures by using the surgical treatment methods that ensure a reliable fixation, reduce the number of complications, make it possible to carry out early rehabilitation, and reduce the treatment time.

Materials and methods

We studied the results of surgical treatment of 78 patients with fractures of the proximal femoral metaepiphysis (A type - extra-articular trochanteric fractures, and some B1-B2 intracapsular femoral neck fractures in accordance of AO/ASIF classification) for the period of 2015 to 2016 in Traumatology Department of Zaporozhye Regional University Hospital. First group: osteosynthesis with an angular stable plate (locking compression plate, LCP) was applied in 30 patients. Second group: intramedullary osteosynthesis with blocking rods (proximal femoral nail antirotation, PFNA) was applied in 42 patients. Third group: in 6 cases, other fixation methods were applied. Subsequently, clinical and X-ray examinations were performed in 6 weeks, then in three, six, and 12 months after the surgery. The treatment results were evaluated with visual analogue scale (VAS), the criteria of the R. M. d'Aubigne system — M. Postel (1954), and the Harris W. H. scale (1969).

Research findings and discussion

Setting the bone in its anatomical position was achieved in 100% of cases; fracture fusion in the period of 12 months was achieved in 96.15% (75 cases). The following complications were noted in the first group: 2 fractures of the implant, i.e., femoral plates or screws; and infection of the surgical area in 1 case. In the second group, an early migration of the fixture and non-union of the fracture was observed in 1 case; and infection was observed in the surgical area in 1 case. In the proximal femoral fractures, positive results were observed in 94.88% of cases when evaluating surgical treatment with the R.M. d'Aubigne - M. Postel scales, and in 93.59% of cases when evaluating surgical treatment with the Harris W.H. scale. The average score as per VAS was 2.5 in the early postoperative period after

proximal femoral fractures fixation; and it was 4.2 when fixing the fracture with LCP plates. As a result of the treatment applied, all the patients rehabilitated their ability to work and were able to return to their former lifestyle.

Conclusions

Evaluation of the results of surgical treatment of patients with proximal femoral fractures showed a higher efficiency of intramedullary osteosynthesis with a PFNA rod than that of the extramedullar osteosynthesis with an LCP plate. Thus, osteosynthesis with the PFNA rod can be the method of choice for surgical treatment of A type fractures and some B1-B2 type neck fractures; the method makes it possible to carry out stable fixation of fragments and early patient activation; and eventually, to improve the results of treatment of patients with proximal femoral fractures.

PECULIARITIES OF TREATMENT OF INJURIES OF THE KNEE JOINT CARTILAGE

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Introduction

The restoration of the knee cartilage defects is an extremely relevant problem of modern orthopedics and traumatology. The results of a large number of studies, which confirm its relevance, are regularly published.

The following are the methods of chondroplasty of cartilage defects, which are used in clinical practice. We divide them into the groups:

1. Defect processing to stimulate spontaneous regeneration:
 - a) abrasive plastic of the bottom of the defect;
 - b) tunneling the bottom of the defect;
 - c) microfracturisation of the bottom of the defect.
2. Replacement of defects with autologous material:
 - a) mosaic plastic;
 - b) plastic surgery of the defect with a periosteum with autospongious filling of the defect;
 - c) transplantation of autologous chondrocytes
 - d) transplantation of mesenchymal stem cells
3. Alloplasty of cartilage defects
4. Replacement of defects with artificial implants
 - a) biodegradable membranes
 - b) metal or polymer implants

Research objective: Identifying factors that significantly affect the outcome of the treatment of the defects of the knee joint cartilage.

Tasks:

* Conducting a retrospective analysis of the results of chondroplasty, depending on the area of the cartilage defect of the knee joint.

* Studying the relationship between the degree of narrowing of the joint space and the result of chondroplasty of the cartilage defect of the knee joint.

* Analyzing dependence between the results of chondroplasty of cartilage defects and the biomechanical relationships in the knee joint.

* Developing an algorithm for selection of indications for chondroplasty of cartilage defects, which is based on complex criteria and takes into account arthroscopic indicators of the condition of the joint cartilage and biomechanical relationships in the knee joint.

Materials and methods

The paper analyzes the results of treatment of 176 patients with osteoarthritis of the knee joint, with the patients operated at least 8 years ago. All the patients underwent plastic surgery for cartilage defects using various methods. The average age of patients was 47 years (patients aged 37 to 61 years). The study included patients with a lesion of the medial femoral condyle, while taking into account only the defects of cartilage and damages of grade III as per Outerbridge classification.

The following surgery techniques were used: microfracturization of 142 patients and mosaic plastics in 34 patients.

We managed to examine 149 (84.7%) of the 176 patients in a long-term period. The terms of evaluation results were within the range of 8 to 14 years.

When analyzing the results, we took into account the assessment according to the Lequesne index, the X-ray progression of osteoarthrosis on the basis of the height of the joint space that was evaluated by the method recommended by Osteoarthritis Research Society International.

Analysis of the results showed that not all the signs studied may be significant in predicting the progression of osteoarthritis of the knee joint.

According to our research, the most significant factor was the value of the medial tibial angle. When determining the correlation between this indicator and indicators of the osteoarthritis severity in the long term after injury (Lequesne index, degree of joint space narrowing), the correlation between these signs happened to be the highest.

It should be noted that the indicators characterizing the initial state of the knee joint also had an impact to the outcome of the treatment of patients. So the values of the Lequesne index before the operation showed an average correlation with the indices of the degree of narrowing of the joint space in the remote period after the injury.

It should also be noted that an average correlation was found between patient's age and the long-term outcome of treatment.

We were surprised that a statistically weak correlation was between the area of cartilage defect and the long-term result of treatment.

Conclusions

A patient's age factor was found to be statistically significant for predicting the progression of osteoarthritis. The best results were obtained in patients younger than 40 years. The age group of 40 to 55 years showed satisfactory results.

The impact of the area to the result of treatment of the knee cartilage defect was insignificant, as evidenced by a lack of correlation between the area of the defect and the long-term results of the treatment of patients.

An important factor in predicting the results of treatment of a defect of the articular cartilage is the initial state of the knee joint, a high correlation is found between the degree of narrowing of the joint space before the operation and the results of patient treatment.

The most significant parameter for predicting the treatment of cartilage defects of the knee joint is the indicator of the medial tibial angle. No positive results of treatment of cartilage defects were obtained at the medial tibial angle of 86° and less.

The geometry of the distal femur was not too variable, and for this reason it failed to affect significantly the results of treatment of patients.

The results of the restoration of the defect of the knee joint condyle cartilage do not depend on its area, but is largely determined by the biomechanical relationship in the knee joint and its initial state: the age of the patients and the degree of joint space narrowing.

Thus, positive results of the treatment of knee joint cartilage defects may be expected when the joint space of the knee joint is narrower than degree I (according to the Osteoarthritis Research Society International), with a medial tibial angle being 87° and higher, and the patient age being 55 years and younger.

It cannot be argued that patients who do not fully fit into these criteria may not have positive results. However, based on the data of statistical analysis, it is impossible to give a sufficiently accurate forecast of a positive outcome of treatment.

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SUBTALAR ARTHROERESIS IN TREATMENT OF PLANOVALGUS FOOT DEFORMITY (finite-element modeling)

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Introduction

Subtalar arthroeresis is one of the main options of minimally invasive surgical treatment of planovalgus foot deformity both in children and in adults. The tapered structure of the implants used for subtalar arthroeresis has a number of disadvantages: in case of installing implants in the subtalar sinus, pain syndrome, instability and aseptic inflammation may appear, and as a consequence, there is a need to remove the implant. The cylindrical form of the implant, which is installed directly in the subtalar canal, must prevent or reduce the negative effects mentioned.

Research objective: Conducting a comparative analysis of a stress-strain state in case of subtalar arthroeresis with tapered and cylindrical implants.

Materials and methods

Researches of stress deformed state of mathematical models of the foot were carried out by the finite element method in normal conditions, in valgus foot deformity, and when using corrective implants of different designs and made of different materials. The researches were carried out by the laboratory of biomechanics of “Professor M.I. Sitenko Scientific Research Institute of Spine and Joint Diseases”. For this purpose, a finite-element model was built, which consisted of elements of the tibia, fibula, heel bone, subtalar bones, navicular bone and cuneiform bone. Articular surfaces were modeled by elements

with mechanical properties of cartilage tissue. Valgus foot deformity was modeled by changing the geometric indices of the location of the model elements. The models of two implants were compared: a tapered implant and a cylindrical one that was developed by ISJD. Also, implants made of different materials - titanium, sapphire and carbon - were studied; the modeling was carried out by changing mechanical properties of the implants, namely, Young's modulus (elastic modulus) and Poisson's ratio. The models were loaded with a vertically distributed force of 350 N which was applied to the tibial plateau. The models had a hard fixation on the supporting surface of the heel bone and on the cut of cuneiform bones. A 10-nodal tetrahedron with quadratic approximation was chosen as a finite element. Mechanical properties of biological tissues were chosen according to the data most often found in the academic literature on the subject. Characteristics of artificial materials were selected according to the technical publications.

Research findings

In case of a normal foot structure, the stresses in foot bone elements are evenly distributed, and they have low absolute values observed within the range of 0.1 to 1.7 MPa. Zones with an increased stress level are observed on the support surface of the heel bone wherein the stress reaches the maximum value of 4.9 MPa. Valgus foot deformity leads to an increase in the general stress in the foot bone elements, up to the range of 0.9 to 4.2 MPa. The zones with a high stress level are observed on the support surface of the heel bone (7.2 MPa), on the navicular bone (6.9 MPa), and on the back portion of the articular surface of the talar bone in the area of the talocalcaneal joint wherein the stresses reach the maximum value of 13.5 MPa.

The use of corrective implants leads to an increase in the stress levels in the area wherein the implants make a contact with the bone tissue, which is attributed to a large difference in the values of the elasticity modulus of artificial materials and the bone tissue. The use of corrective implants in other elements of the foot bone system leads to a decrease in the stress levels compared with the model of the valgus foot deformity. It is most evident on the surface of the talocalcaneal joint wherein the stress reaches the level of 8.0 and 7.1 MPa when using tapered and cylindrical implants, respectively, in comparison with the model of valgus foot deformation wherein the stress level is 4.2 MPa. Thus, the use of corrective implants in other parts of the model leads to a decrease in stress levels due to the correction of the geometric relationships between the model elements. The difference in stress levels in all the sections of the feet models with tapered and cylindrical implants is very small; however, this difference is in favor of a cylindrical implant. The main differences between implant models made of different materials are observed in the area wherein the implants make a contact with the bone tissue. The difference is insignificant in other parts of the models. The main factor that affects the level of stress indicators is the magnitude of the modulus of elasticity of the materials which the implants are made of. However, the absolute values of the differences in the models are very small in terms of the stress levels; therefore, it is impossible possible to determine the advantages of implants made of various materials.

Conclusions

1. Valgus foot deformity leads to an increase in stress in all the elements of the "tibia-foot" bony system, especially on the support surface of the heel bone and on the surfaces of the talocalcaneal joint.
2. The use of implants for arthroeresis has a positive effect on the distribution of stresses in the elements of the foot skeleton in case of correction of valgus foot deformity; with cylindrical implants having an advantage over tapered ones.

3. The material used for implants for arthroeresis is not critical in terms of the stress distribution in the elements of the "tibia-foot" bony system.

INSTABILITY OF JOINTS: CONCEPTUAL MODELING OF THE PROBLEM ON THE EXAMPLE OF THE TALOCRURAL JOINT

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The term "instability of the joint" has been used in domestic and foreign publicatuions for a lond time and in various interpretations, e.g., instability of the shoulder, knee, hip and talocrural joint, etc. In this context, the local approach is used to diagnose and treat instability of the joint(s) in most cases: numerous diagnostic and therapeutic measures (methods) were developed to restore joint stability in accordance with the localization and type of the instability of each particular joint, without taking into account the condition of other parts of the musculoskeletal system. E.g., currently, only surgeries for the instability of the talocrural joint (ITCJ) constitute more than one hundred. This number of the surgeries shows, on the one hand, a great variety of instability types of the talocrural joint and, on the other hand, it shows a lack of harmonized standard approaches to the elimination of the instability of the talocrural joint, and also a certain dissatisfaction with the current treatment outcomes as well.

It should be stressed that a local approach to solving the instability of a particular joint fails to make it possible to assess the status of both the musculoskeletal system in general and its individual parts in particular. Nevertheless, quite often the instability of a particular joint occurs on the background of the existing congenital or acquired disorder (deformity) of the musculoskeletal system, which is located above or below the affected joint. Also, quite often instability of the joint(s) arises in cases of undiagnosed disorder of the soft tissue of the joint or in case of a combination of a soft tissue disorder with a bone disorder.

Thus, no systematic approach to solving the problem of "instability of the joint" exists up to date; it does not make it possible to analyze the causal relationship between the structure and the function of the joint elements, and the degree of their damage (deviation from the norm), and to substantiate and implement on this basis an algorithm of a diagnostic and treatment system for the disorder above mentioned.

No a single approach, which would make it possible to develop, on the one hand, a harmonized classification of "joint instability" irrespective of its anatomical location, and, on the other hand, to develop and implement standardized principles of diagnosis, treatment and prevention, preserving an individual approach to each patient.

Research objective: Developing a general concept of "instability of the joint; substantiating the principles of prevention, diagnostic, and therapeutic tactics fot this condition on the example of the talocrural joint.

Material and methods

The method of conceptual modeling, the systematic integration approach to solving the problem of "instability of the joint", and the instability of the talocrural joint in particular, are used in the work.

Research findings and discussion

The "instability of the joint" means pathological displacement of the joint components (articular ends) in one or more planes, which leads to its disfunction; it is accompanied by a certain clinical picture in accordance with the anatomical localization. A general concept of "instability of the joint" was developed, which makes it possible, on the one hand, to develop a unified classification of this condition regardless of its anatomical localization, and, on the other hand, to introduce standardized principles of diagnosis, treatment, and prevention of "instability of the joint", with an individual approach to each patient preserved.

The above mentioned classification of the "instability of the joint" is based on the etiology, pathogenesis, degree, and stage of the injury in each joint. The classification includes disease severely; acute and chronic instability; dysplastic, posttraumatic, and degenerative instability; instability in different planes (front and back, medial and lateral), etc.

Our attention was drawn to the talocrural joint (TCJ) as its injuries occupy one of the leading places among the damages of the lower extremities, and the constitute, according to various authors, from 10 to 20% of all injuries of the musculoskeletal system, and damages of the talocrural joint ligaments occur in 35-50% of such cases (Kodirov M.F., 2004; Vega J., Golanó P., Pellegrino A., 2013).

The talocrural joint represents a system including several subsystems closely interconnected in terms of structure and function; each of them, in turn, consists of a number of elements: bony formations, such as tibia, fibula and talar bone; ligaments of the talocrural joint and tibiofibular syndesmosis; muscles to provide movement in the talocrural joint; capsule of the talocrural joint; blood vessels and nerves. It should be taken into consideration that the talocrural joint function is influenced by deviations of a different genesis (congenital, post-traumatic, etc.) both in the structures, which constitute this joint, and in the entire lower limb.

Thus, locus morbi may be localized both in separate components of the talocrural joint and in the system as a whole, which causes the variety of complaints, clinical manifestations and various syndromes, with each syndrom requiring an individual diagnostic and therapeutic (conservative or surgical) approach.

With respect to the talocrural joint, the syndromes that lead to the development of the talocrural joint instability (acute and chronic) should be highlighted:

1. Syndrome of soft tissue imbalance of talocrural joint (primarily, a different degree of damages and disfunction of ligaments and muscles);
2. Intra-articular syndrome (the talocrural joint has obstacles to normal movements in it: scars, ossificates, foci of chondromalacia, etc.);
3. Syndrome of inconsistency of the block of the talar bone and the "fork" of the talocrural joint in the shape and size (the so-called "impjgment syndrome");

4. Syndrome of deformity of the bones forming the talocrural joint, which has different genesis (post-traumatic or congenital): in the frontal plane (valgus or varus deformity of the lower third of the tibial bones); in the sagittal plane (anteversion or recurvation deformity of the tibia, deformity of the block of the talar bone, torsion deformities, as well as their combination (multi-plate deformities in the area of the talocrural joint));

5. Syndrome of the damage of tibiofibular syndesmosis;

6. Syndrome of underdevelopment of bone elements of the talocrural joint (hypoplasia/ aplasia of the tibia and medial bone, anomalies of the development and structure of the talar bone, etc.);

8. Syndrome of destructions and reactive changes in the talocrural joint (including aseptic necrosis of the talar bone);

9. Syndrome of bone injury or bone structure anomalies that are not directly related to the talocrural joint: deformities of the femur and / or heel bone, anomalies of the middle and anterior portion of the foot, etc.

In view of the above, we constructed and practically applied the diagnostic algorithm for various pathological syndromes of the talocrural joint; also we developed a working classification and "Bank" of surgical interventions, which includes a set of typical modular surgeries; it ensures the elimination of various pathological syndromes of the talocrural joint and their combinations.

Conclusions

The conceptual modeling of the problem of "instability of the talocrural joint" and the highlighting of certain pathological syndromes of the talocrural joint made it possible to develop an algorithmized system of diagnostic and treatment for this disorder. Due to the detailed diagnosis, we have opportunity to use a certain set of therapeutic measures (primarily, surgical interventions) aimed at the complete restoration of impaired anatomy and the function of the talocrural joint.

Further research is required for clinical verification of the theoretical positions stated, as well as a number of special studies (biomechanical, morphological, radiological, etc.) to determine the prognostic criteria for the functioning of the talocrural joint.

MECHANICAL CHARACTERISTICS OF SUSPENSION FIXTURES WITH ADAPTIVE LOOP FOR RECONSTRUCTION OF THE ANTERIOR CRUCIATE LIGAMENT

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Reconstruction of the damaged anterior cruciate ligament (ACL) today is a routine surgical intervention. Impaired graft fixation and lengthening are the most common causes of instability. New techniques and fixtures appear, with the data on the suboptimal graft fixation by using interference screws taken into account. In particular, these are cortical button clamps; however, there are still doubts as to their mechanical strength and ability to lengthen under cyclic loads.

Research objective: Evaluating the possibility of using a cortical fixator with an adaptive loop of our own manufacture on the basis of its mechanical characteristics.

Materials and methods

We tested 2 types of cortical fixators with an adaptive loop: 1) TightRope ACL (Arthrex Inc., Naples, FL) of reverse tension; 2) domestically produced cortical fixture that consists of a button plate and Fiberwire No. 2 thread (Arthrex Inc., Naples, FL). The study was carried out by using a bursting hydraulic machine. First, a constant preload of 50 N was applied for 30 seconds to determine a preload elongation. Then, cyclic sinusoidal loads of 50 to 250 N were applied with a frequency of 2 Hz, with the number of cycles being 2,000. Cyclic lengthening was recorded after 50; 100; 500; 1,000 and 2,000 load cycles. Then, we continued stretching the loop with an elongation of 1 mm/s to determine the maximum tensile strength.

Research findings

The difference in average preload elongation was not statistically significant for the domestically produced cortical fixture and for the factory fixture: 2.07 ± 0.3 mm and 1.95 ± 0.2 mm ($p > 0.05$) respectively. When comparing the total cyclic elongation after 2,000 load cycles, the difference between the elongation of the factory-made cortical fixture and the domestically produced fixture was also statistically unreliable: 1.1 ± 0.1 mm and 1.21 ± 0.13 mm ($p > 0.05$) respectively. The total elongation (preload and cyclic) for the factory fixture was 3.05 ± 0.95 mm, and for the domestically produced fixture was 3.28 ± 0.22 mm. The difference in the maximum tensile strength between the two types of fixtures is statistically insignificant ($p > 0.05$) and it was 876 ± 56 N for the factory-made cortical fixture, while for the domestically produced cortical fixer it was 953 ± 48 N.

Conclusions

The total loop elongation was 3.05 ± 0.95 mm for the factory-made fixture and 3.28 ± 1.05 mm for the domestically produced one. The total elongation consisted of a preload elongation (1.95 ± 0.2 mm for the factory-made fixture and 2.07 ± 0.3 mm for domestically produced one) and a cyclic elongation (1.1 ± 0.1 mm for the factory-made fixture and 1.21 ± 0.13 mm for the domestically produced one).

Given that the total elongation may be reduced intraoperatively to 1.1 ± 0.1 mm for the factory-made fixture and to 1.21 ± 0.13 mm for the domestically produced fixture due to the pre-load elongation component, we can say that both types of fixtures may be applied in clinical practice. Moreover, sufficient tensile strength of both fixture types, which covers the necessary loads on the anterior cruciate ligament (ACL) graft when walking (about 340 N according to data exposed in academic literature on the subject) [20, 21], allows recommending it for a widespread use in ACL reconstructive surgery.

Keywords: anterior cruciate ligament (ALC), cortical fixture, mechanical strength

MRI CRITERIA FOR THE ALTERATION OF THE ANTERIOR CRUCIATE LIGAMENT GRAFT

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The anterior cruciate ligament injury is one of the most common injuries of the knee ligaments. MRI plays an important role in assessing the integrity of the graft, and it also helps to identify complications associated with the reconstruction of the ACL. We found only one paper in academic literature on the subject: its authors evaluated the process of changing the structure of the graft by using an MRI without a contrast; however, a small number of patients (21) were examined.

Research objective: Developing MRI criteria for evaluating the alteration of the ACL graft.

Materials and methods

The study group included 95 patients after restoration of the anterior cruciate ligament. MRI was carried out in 3, 6, 9, and 12 months after the surgery. The dynamics of the ACL graft remodeling was assessed by the intensity of the MR signal at T2 and proton density-weighted (PDW) modes. To rule out the subjectivity of the MRI assessment, the signal / noise ratio was used. Also, the general view of the ACL graft was evaluated as per the degree of its homogeneity by a 3-point scale. The data obtained were also compared to the survey data on 50 patients with an intact ACL.

Research findings

The signal-to-noise ratio gradually decreased when carrying out examination in 3, 6, and 9 months after the surgery. It says that the graft alteration continues in all its parts (femoral, median and tibial) within this period of time. When examined in 9 and 12 months after the surgery, no a statistically significant change was found in the signal / noise ratio. When comparing the data obtained with the examination data of the patients who had an intact anterior crucial ligament, it may be noted that the intensity of the signal from the ACL graft did not reach the intensity of the signal of the intact ligament even in 12 months after the surgery.

Conclusions

Based on the analysis of MR images in T2 and proton density-weighted (PDW) modes, we developed a new method for assessing the dynamics of the recovery of the ACL graft in the postoperative period. To evaluate the signal intensity, we used the signal-to-noise ratio and the qualitative assessment of the general view of the ACL graft as per the degree of its homogeneity by using a 3-point scale.

REHABILITATION OF PATIENTS WITH MULTIPLE INJURIES OF LIMB LONG BONES

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Introduction

Multiple diaphyseal fractures of the limb bones occupy a significant place (7.7% to 29%) among the injuries that cause disability. An individual complex of physical exercises and therapeutic gymnastics is an important additional factor that should be used to recover working capacity of patients with multiple injuries of the limb bones as soon as possible. Early motor activity of patients increases the tone of the skeletal muscles, eliminates functional contracture, accelerates the restoration of the function of the hepatobiliary system, the gastrointestinal tract, urinary tract, and improves lymph and blood circulation. Introduction of the principle of early motor activity to the practice reduces the incidence of flatulence and paresis of the intestines.

Research objective: Early return of injured persons to socially useful work.

Materials and methods

255 patients were treated with multiple diaphyseal fractures of the limb bones in various clinics of M. Gorky Donetsk National Medical University for the past decade. Most often, the majority of fractures were observed in persons of working age – 70.6% (180), and mainly in men – 81.6% (208). Most of the fractures were the result of road accidents - 40.4% (103); occupational injuries were in 23.5% (60) cases. At the rehabilitation stage, the most widely used treatment was magnetotherapy, electrophoresis of various drugs, pulsed currents of low and high frequency, ultrasound, and laser therapy. Started from the first days after the injury, physical exercises contribute to the improvement of local blood circulation and resorption of hematoma by stimulating regenerative processes. Unlike isolated injury, the likelihood of contractures in the large joints of both upper and lower extremities increases when treating patients with multiple diaphyseal fractures of the long limb bones. Therefore, it is necessary to provide early functional treatment in those joints.

Post-traumatic contracture in the knee and elbow joints was diagnosed in 15.2% (12) cases. In patients suffering from slow restoration of joints, the device developed by us for movement workout in large joints of the limbs (Ukrainian patent 21435A) was used by the patients themselves along with physical functional treatment. The user friendliness and simplicity of use of this device for movement workout in the knee (elbow) joint by the patients themselves allows the device to be controlled by both the nursing staff and the patient himself.

Research findings and discussion

The treatment results in the near term after the injury were studied in 225 persons with multiple injuries of limb long bones. The treatment results in the long term after the injury were studied in 243 (95.3%) patients. The peculiarity of the restorative treatment of patients with multiple diaphyseal fractures of limb long bones is the use of a consistent individual step-by-step complex of active motions, depending on the activity of the reparative processes. Permanent medical management, treatment in the rehabilitation departments with the use of all types of physiotherapy and mechanotherapy, especially exercises in the aquatic environment, is a powerful incentive for the development of compensation and contributes to the rapid return to work in patients with multiple musculoskeletal injuries. It should be noted that the primary task for the treatment of these patients is the struggle to save their lives. Surgery treatment with the use of extracortical and percutaneous osteosynthesis is the main method to treat this type of severe injury and the first important stage of a restorative treatment. Analysis of the consequences of treatment of patients with multiple diaphyseal fractures of limb long bones suggests that, despite the injury severity, the use of the combined treatment method (106 -60.9%) in accordance with clear indications in most cases (97-91.5%) ensured satisfactory results. Complications incidence was 6.8% (12 cases). Disability incidence was 5.7% (10 cases), with most of those patients (3.4% - 6 cases) were recognized as third-group disabled persons. Fatal consequences incidence was 0.8% (2 cases), which was due to extensive musculoskeletal injuries.

Conclusions

The key to the success of the treatment of patients with multiple diaphyseal fractures of limb long bones is the correct choice of a surgical treatment method, adequate medical therapy, and the timely start of a rehabilitation treatment. The peculiarity of the restorative treatment of patients with multiple diaphyseal fractures of limb long bones is the use of a consistent individual step-by-step complex of active motions, depending on the activity of the reparative processes. Permanent medical management, treatment in the departments of rehabilitation therapy using all types of physiotherapy and mechanotherapy is a powerful incentive for the development of of compensatory abilities of the

human body and contributes to the rapid return to work in patients with multiple musculoskeletal injuries, which made it possible to obtain good anatomical and functional results in 86.6% of cases.

TREATMENT AND REHABILITATION OF UNCOMPLICATED SPINE INJURIES

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The spine is a complex osteoarticular apparatus that is the axis of the human body. It consists of individual vertebrae, intervertebral discs, and a well-developed musculoligamentous system.

Spinal injuries are observed in the cervical, thoracic, lumbar and sacral spine regions and may be divided in accordance with the following classification:

1. With a spinal cord damage;
2. Without a spinal cord damage.

We considered only the spinal injuries of the second category.

Spinal injuries may be divided in accordance with the injury localization:

- fractures of the vertebral bodies (compression or burst fractures);- fractures of the spinous and transverse processes;
- fractures of the vertebral arches;
- subluxation of the vertebrae (without damage to the spinal cord).

Treatment of spinal injuries begins with immobilization and pain relief.

Compression and burst fractures of the vertebral bodies are observed in the lower cervical, lower thoracic and upper lumbar regions, i.e. in the most mobile part of the spine.

Treatment is carried out by the method of single-step or gradual spinal column reclinatio followed by the imposition of a corset or spin extensor; if the method is inefficient, surgery will be used. Using physiotherapeutic methods in the early period is obligatory (exercise therapy, massage and physiotherapy).

Fractures of the spinous processes of the vertebral column

Isolated fractures of the spinous processes are quite rare. Lower cervical and upper thoracic vertebrae are more often damaged.

The treatment includes local anesthetics, bedrest (about 1 month); the use of a corset is possible, if the cervical column is damaged, a Schanz collar may be used and, in rare cases, a thoraco-cranial dressing, along with physiotherapy treatments. If conservative treatment is inefficient, surgical treatment is indicated.

Fractures of vertebral arches

The cervical vertebral arches are most often damaged. Comminuted fractures of the vertebral arches may cause irritation of the spinal membranes and compression of the spinal cord. Such injuries are treated with traction and subsequent use of a Schantz collar.

Fractures of the transverse processes usually occur in the lumbar region. A direct injury or a sharp contraction of the muscles when a person makes a sharp turn (especially with a load) leads to a fracture of the transverse processes.

Treatment begins with local anesthesia and, in some cases, blockade, and then immobilization of the patient in an orthopedic bed. Anesthesia is repeated for 6-7 days.

Treatment of spine subluxation

Treatment has two main vectors: conservative and operative. Simultaneous reposition of the vertebrae is performed in the first 10 days after injury; the use of local anesthesia is possible. In case of inefficiency, skeletal traction is used with clips fastened to parietal protuberances.

Rehabilitation

When cervical vertebrae are damaged, the rehabilitation of patients who undergo permanent skeletal traction or traction with the Glisson loop begins with breathing exercises and physiotherapy. The patient should do 5 or 6 deep breathing movements and cough up sputum in every 2 or 3 hours under control of a supervisor.

The patient should perform therapeutic exercises in prone position in 2 or 3 days: exercises for the neck and trunk muscles, muscles of upper and lower extremities. Isometric muscle tension for a period of 2-3 to 5-7 seconds is used to strengthen the neck muscles; the exercises are performed 3 or 4 times a day, each lasting for 15 to 20 minutes.

Rehabilitation for fractures of the thoracic and lumbar vertebrae

Exercise therapy is prescribed to the patient in a good performance status from the first days.

At the first physiotherapy stage (about 2 weeks), breathing and combined developing exercises for muscles are used. Initially, the patient should not lift the heels from the bed. Further, exercises are added to bend the spine and strengthen the muscles of the abdominal cavity. The duration of exercises is 10-15 minutes; they are performed 3-4 times a day.

At the second physiotherapy stage (about 4 weeks), exercises for the muscles of the upper and lower limbs, trunk, and back are included. The exercises are performed when the patient is in supine and prone position. The patients should be trained to move to prone position. The patient should change the position of the body several times a day. In the second half of the period, the lateral trunk inclinations, rotational movements, and bending of the spine are added. Forward trunk inclinations are prohibited.

At the third physiotherapy stage (about 2 weeks), except for exercises in supine or prone positions, movements are included when the patient is on his knees. The duration of such training is 30-45 min.

The fourth stage begins in 2 months after the injury. The patient is transferred to a vertical position from the position when he is on his knees. After adaptation to the vertical position, controlled walking is practiced. Initially, it is recommended to get up 2-3 times a day and walk no more than for 15-20 minutes. Besides walking and special exercises in unloading positions, exercises are used in a standing position. It is necessary to strengthen muscles of the legs and the feet.

Exercises for the trunk are performed with large amplitude; however, forward inclinations are ruled out. By the end of the third month after the injury, the walk duration may reach 1.5-2 hours; the patient is allowed to sit in 3-3.5 months after the injury. It is permitted to do forward trunk inclinations, but initially, with a tense arched back. Especially effective spinal functions are restored when

swimming.

In spinal injuries, the effect of physiotherapeutic rehabilitation is due to electro-, light- and heat treatment.

ETIOLOGY OF INFECTIOUS COMPLICATIONS IN VARIOUS METHODS OF OSTEOSYNTHESIS IN PATIENTS WITH LESIONS OF EXTREMITIES

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Introduction

Treatment of patients with infectious complications of severe trauma is one of the urgent problems of modern traumatology. Purulent-septic lesions of the limb bones appear in more than 20.0% of those patients. Appropriate modern antibiotic therapy is among the factors able to stop the development of an infectious complication after using various methods of stable osteosynthesis, and to contribute to its elimination.

To substantiate antibiotic therapy, the etiological diagnosis of the complication or the objective monitoring data in the absence of the pathogen selected should be timely and objectively established. As is known, the etiological diagnosis of the infectious-inflammatory process, in addition to identification and biological characteristics of the microorganism recovered from the clinical material, implies proof of its etiological role in the development of complications. Such confirmation is considered to be the detection of a specific antibody response to the activity of the microorganism and its level in the patient, including the mandatory consideration of the concentration of C-reactive protein (C-RP) as an indicator of the activity of the process, which makes it possible to clarify the diagnosis and contribute to optimization of appropriate antibiotic therapy.

The purpose of this work was to determine the etiology of infectious complications in patients with various types of osteosynthesis of long bones, namely, when using plates or BIOS to optimize objective diagnosis and antibiotic therapy.

Materials and methods

1469 samples of clinical materials were microbiologically tested, with the materials taken from 432 patients with complicated osteosynthesis of the bones of the lower and upper extremities. The patients were admitted at Clinic of Bone and Purulent Surgery of State Institution "Institute of Traumatology and Orthopedics of Ukraine" under National Academy of Medical Sciences of Ukraine (NAMN), Kiev, Ukraine, within the period from 2005 to 2014. The study of clinical material was carried out in terms of bacterial cultures in accordance with valid methodological recommendations.

In 512 patients with complicated osteosynthesis, serological tests were performed. 906 serum samples were investigated. The concentrations of antistreptolysin-O and C-reactive protein were determined by

using diagnostic reagents manufactured by "Human". Diagnostically significant titers were considered the values > 6 mg/L; 200 IU/ml, respectively. To detect anti-staphylococcal antibodies in the serum, agglutination reaction was carried out with polyvaccine heated up to 65°C ; and to detect antibodies to isolated cultures, agglutination reaction was carried out with the same vaccine from autostrain heated or live species

Research findings

Microbiological researches were carried out in patients divided into groups in accordance with the localization of the lesion, namely: lesion of the tibia in 228 patients; lesion of the femur in 151 patients; lesions of the upper limb in 53 patients. Taking into account changes of osteosynthesis devices that occur with the years, the species specificity of the pathogens, which cause infectious complication, and their antibiotic resistance in dynamics after the years of follow-up (2005-2014) was studied. The obtained data on the comparison of the indicators of the frequency of the recovery of microorganisms and their species specificity, depending on the localization of inflammatory and infectious complications in the bones of the tibia, femur, and large bones of the upper limb, and the type of osteosynthesis showed certain patterns.

The analysis showed no dependence on localization in a part of patients (90.0-90.8%) with the recovery of culture of microorganisms. The main causative agent was *S.aureus* in all the groups (68.7-72.8% of patients); Methicillin-resistant *Staphylococcus aureus* (MRSA) was most often recovered in patients with femoral lesion (31.3% of the number of patients who recovered *S. aureus*); it was a little less frequent in patients with lower limb lesions (24.2%) and almost 3 times less often in patients with lesions of the tibia bones than in patients who recovered *S.aureus*. The same trend is observed in the selection of coagulase-negative staphylococci (CoNS) and their methicillin-resistant (MR) versions, although the number of patients with CoNS recovery is 3 times less than the number of patients with *S. aureus* recovery.

The frequency of recovery of all other microorganisms did not differ in lesion of the tibia and femur, and it was 1.5-2 times less in patients with lesions of upper limb bones, and 7.5-8 times less in patients with recovery of *Enterococcus faecalis*. This may indicate both the greater role of hospital infection in patients with lower limb lesions and their significant role in endogenic infection contamination.

Serologic tests were carried out to confirm the etiological diagnosis and confirm the role of *S.aureus*, *S.pyogenes*, and the microorganisms recovered from patients in the development of infectious complications.

Thus, the leading role of *S.aureus* was confirmed in 95.5% of the patients examined compared to 70.7% of patients who recovered *S. pyogenes*. *S.pyogenes* was found approximately in 44.7% of patients in all groups due to the detection of diagnostic levels of anti-streptolysin-O, which is a real proof of its objective etiological role in comparison to microbiological data (3.6% of the patients who recover the microorganism). The role of gram-negative microorganisms was confirmed in the agglutination reaction with autocultures in each patient by detecting antibody titers (29.6%), which determined their etiological significance and directed the appointment of efficient antibiotic therapy corresponding to the pathogen.

Diagnostic levels of C-reactive protein (C-RP) were registered approximately in 78.9% of patients, more than half of them (57.2%) had high levels of C-RP (48-96 µg/ml), which indicated the activity of the infectious process in them.

Conclusions

The analysis of the results of microbiological and serological research made it possible to confirm objectify the etiological diagnosis of infectious complications in patients after osteosynthesis of long bones, which was carried out as per different techniques, and to administer an efficient antibiotic therapy that correspond to the pathogen.

MORPHOLOGICAL PECULIARITIES OF THE REPARATIVE PROCESS OF THE CLOSURE OF THE DEFECT OF JOINT CAPSULE WITH A RETICULAR POLYPROPYLENE IMPLANT

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The incidence of hip dislocation in primary hip joint replacement is within the range of 0.5 to 2%, while recurrences occur in 16-59% of patients after a primary dislocation and closed reduction. A wrong position of the implant components ranks first is among the causes of dislocations. However, there are cases when dislocations occur even with satisfactory setting of implant components. It is most often associated with the defect of the joint capsule-ligament apparatus, e.g., intracapsular fractures of the femoral neck, tearing, false joint or migration of the greater trochanter, which occurs when using transtrochanteric access, etc. Thus, the weakness of the capsule-ligament apparatus ranks second among the causes of dislocation of the hip joint implant. The Department of Traumatology proposed a method to prevent dislocations of the hip joint implants, which are associated with weakness of the joint capsule-ligament apparatus, by closing the defect with a polypropylene mesh.

Experimental modeling of the joint capsule plastic with a polypropylene mesh was performed in the department. The work was carried out in full compliance with the ethical principles established by the European Convention for the Protection of Vertebrate Animals used for experimental and other scientific purposes. Operations (n = 45) were performed on rabbits under general anesthesia with thiopental. The animals were removed from the experiment on the 14th, 21st, and 45th day with an overdose of thiopental.

A pronounced inflammatory response with activation of resident macrophages and fibroblasts was observed at early stages, as well as migration of blood cells towards the injury site and a pronounced blood clot that initiates the formation of granulation tissue. The formation of young connective tissue was observed in all specimens on the 21st day. Collagen fibers formed spiral bundles and nodes around plexus elements; a significant pool of fibroblasts also was present; also a thick connective tissue capsule of about 193 microns was noted along with an adequate vascularization. Formation of a dense fibrous capsule represented by fibrous connective tissue with single adipose cells was noted in a remote period. No implant complications were identified.

A polypropylene-based implant induces formation of connective tissue around its elements to the maximum. The reparative process flow is accompanied by the growth of the connective tissue into adjacent paraarticular structures. The mesh fibers do not develop conditions for the pronounced taxis of the inflammatory pool cells; the migration of fibroblasts, however, remains adequate after hip joint

replacement: all the necessary conditions for the formation of the connective tissue are present. This factor is important in high risk of recurrent dislocation.

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STUDY OF THE STRESSED AND STRAINED STATE OF THE KNEE JOINT MODELS DEPENDING ON THE GRADE OF VARUS KNEE DEFORMITY AND THE THICKNESS OF KNEE JOINT CARTILAGE

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Gonarthrosis is one of the most common diseases of the knee joint. According to B.I. Simenach's theory of genetically determined diseases [1, 2] and the "Arthrosis" model [3] proposed by him, two options of the development of this ailment are possible. In the first case (arthrosis deformity), the presence of congenital or acquired deformity of the knee joint leads to a change in the conditions of its loading, and to the destruction of cartilage and arthrosis later on. In the second case (deforming arthrosis), the presence of congenital or acquired metabolic factors causes an inflammatory process in the cartilage tissue; and later on, it causes destruction of the cartilage, a change in the loading conditions for the knee joint and the development of deformity. A controversial question remains: what is of the key importance in the conditions of loading for the knee joint, the presence of deformity or the absence of cartilage.

Research objective: Studying a stressed and strained state of the knee joint, depending on the grade of the varus knee deformity and the thickness of the articular cartilage.

Materials and methods

To solve the preset task, finite element models of the lower limbs within the variants of the norm and varus deformity of 10 and 15 ° were developed by the laboratory of biomechanics of State Institution "Professor M.I. Sitenko Scientific Research Institute of spine and joint diseases" under National Academy of Medical Sciences of Ukraine, Kharkov, Ukraine. Valgus deformity was not considered since the nature of the changes in the stressed and strained state of the models should correspond to varus deformity with the displacement of peak stresses to the opposite condyle.

The models consisted of the following elements: femur, tibia, patella and articular cartilage. The articular cartilage model was made in the form of two layers, which allowed reducing the thickness of the cartilage by 2 times. Thus, we modeled 2 conditions of the joint with cartilage thickness of 2 mm and 1 mm.

The model had a rigid attachment to the distal tibia. A distributed load of 700 N was applied to the femur head, which corresponds to the load on the limb when standing on one foot.

Research findings

The effect of the varus deformity grade on the distribution of stresses both in the elements of the lower limb in general and in the knee joint in particular was investigated at the first stage of the research work. The varus deformity leads to an increase in stresses along the medial and lateral surfaces of the femoral and tibial bones. The maximum stress values increase as deformity angle increases. At the

same time, the stress level on the anterior and posterior surfaces of these bones decreases, while the stress level in the femoral neck remains almost unchanged. An increase in stress level is observed at the medial side of the articular surface of the knee joint as varus deformity increases.

The next stage of the research work was the study of the influence of the articular cartilage thickness on the stress distribution in the elements of the models. Our research showed that the change in the cartilage thickness had no effect on the level of stresses in the bone structures. Slight changes are present on the articular surfaces.

The most noticeable changes in cartilaginous structures were found in the femoral condyles. As the cartilage thickness decreases, the stresses on the medial condyle decrease from 2.3 to 1.6 MPa, and tension increase from 0.4 to 0.7 Mpa on the lateral condyle. Little changes were found on the articular surface of the tibia. As you can see, the change in the cartilage thickness introduces little changes in the picture of the stressed and strained state of the models.

Conclusions

Normally, stresses in the femoral and tibial diaphyses are distributed evenly along the entire circumference. Varus deformity leads to a redistribution of stresses from the anterior and posterior surfaces of the femoral and tibial diaphyses to their medial and lateral surfaces, with the medial surfaces stressed more. An increase in stresses on the medial side is also observed on the articular surfaces. The maximum stresses in these zones increase as deformity increases.

Changes in the thickness of the articular cartilage in the knee joint have little effect on the distribution of stresses both in the bone structures and on the articular surfaces.

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PHYSICAL REHABILITATION BY USING THE METHOD OF CONTINUOUS PASSIVE MOTION IN JOINTS

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Research objective: Presenting the experience of using the method of continuous passive motion (CPM) in the joints of the extremities in patients with various disorders of the joints of the upper and lower extremities.

Materials and methods

We used devices for automatic movement workout in the joints of the upper and lower extremities, which were developed by State Institution "Professor M.I. Sitenko Scientific Research Institute of spine and joint diseases" under National Academy of Medical Sciences of Ukraine, Kharkov, Ukraine, together with Svarkon LLC, Kharkov, Ukraine. The movement workout was carried out by using devices for automatic movement workout in accordance with the method that takes into account a patient's individual psychological characteristics, the postoperative course, and the severity of the pain syndrome.

Two clinical groups of patients with disorders of the joints of the upper and lower extremities were studied, with the two groups being identical by sex, age, type of the disorder, and type of surgical interventions performed. The first group was a control group; it included 55 patients (63 joints: 31 knee joints, 26 hip joints, and 6 elbow joints). The second group was the main group; it included 75 patients (92 joints: 46 knee joints, 39 hip joints, and 7 elbow joints) who underwent the method of continuous passive motion at various stages of physical rehabilitation in the postoperative period.

Research findings

Ukraine made devices for automatic movement workout (DAMW) were developed under the following conditions: the full compliance with Ukraine legislation concerning medical devices; relative inexpensiveness (the cost of Ukraine made devices is 5-6 times less than that of imported competitor products); the possibility to control smoothly the speed of the movement workout and the angle of joint flexion-extension; easily manufactured and reliable devices; the possibility to adjust the length of the cradles, depending on a patient's anthropometric data.

The treatment results in patients with disorders of the joints of the upper and lower extremities, which underwent the continuous passive motion (CPM) method in the rehabilitation process, were analyzed. A statistically reliable decrease (by 27%) in the rehabilitation period was noted in the main group; as well as an increase in the range of motions in the joints along with a significant decrease (by 45%) in pain, myotonic, and neurodystrophic syndromes. Moreover, the main group patients showed a positive psychological attitude and a desire to "work" on devices for a long time.

Conclusions

1. There is a need to widely familiarize specialists with the method of continuous passive motion in joints, while a shortage of devices for automatic movement workout requires to include the devices in the public procurement register, as well as the to develop individual rehabilitation programs, taking into account the capabilities of the method.
2. The high efficiency of using Ukraine made devices for the automatic movement workout for rehabilitation treatment of patients with various disorders of the joints of the upper and lower extremities was proved; it allows us to recommend that the devices to be widely used in departments, rehabilitation centers and sanatoria of the corresponding profile.

COMPARATIVE CHARACTERISTICS OF THE DYNAMICS OF PAIN SYNDROME PROFILE IN THE PROCESS OF PHYSICAL REHABILITATION OF PATIENTS WITH DISORDERS OF THE KNEE JOINT

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Research objective: Carrying out a comparative characteristic of the dynamics of pain syndrome profile in patients with knee joint disorders in the postoperative period in the process of physical rehabilitation that uses the method of continuous passive motion.

Materials and methods

A comparative analysis of the pain syndrome profile in the process of physical rehabilitation was carried out in 2 clinical groups of patients that were identical in terms of sex, age, type of pathology and type of surgical interventions (52 males and 37 females). In the postoperative period, patients of the 1st group received the standard rehabilitation treatment, and patients of the 2nd group performed passive movement workout besides the standard rehabilitation treatment, in the affected hip joint by using Ukraine made devices for automatic movement workout, which we developed by us together with Svarcon LLC.

Research findings and discussion

Retrospective analysis of the data obtained from questionnaires and further integrated assessment of the anatomical and functional status of the knee joints made it possible to establish that patients had various complaints in various combinations. The most often subjective complaints were as follows: fatigue in the second half of the day, limitation of the range of motion in the hip joint and lameness, as well as complaints of pain different in nature, which depended primarily on the main diagnosis and peculiarities of the load to the diseased limb. The most often objective clinical symptoms were as follows: limitation of the range of motion in the hip joint, gait disorders and lameness, hypotrophy of the muscles of the lower third of the femur. Edema of para-articular tissues and signs of synovitis of the hip joint depended to a greater extent on the duration of the disease.

We have to admit that restorative treatment was conducted, taking into account the psychological characteristics of patients:

- many patients had a negative "white coat" psychological reaction, and even minor local pain in movement workout without automatic movement workout often caused severe pain and myotonic reactions accompanied by the development of rigidity of the joint operated and adjacent joints;
- even the most professional and conscientious trainer of therapeutic exercises or masseur is physically unable to conduct long, multiple individual sessions to workout joints, unlike mechanical devices.

The peculiarities of pain syndrome in patients both in pre- and postoperative period were analyzed in details. In preoperative period, pain syndrome of varying intensity was observed in all patients of both groups (43 and 46 respectively); the pain syndrome was of varying intensity, differed in localization, and it was characterized by various factors that increased or decreased the intensity of pain (unload of the limb in a horizontal position, rest, standing position, fixation of the limb in a forced position, warm-up, taking some analgesics).

A retrospective assessment of the dynamics of pain syndrome profile shows a statistically reliable decrease in the main group, where the method of continuous motions was used in the process of rehabilitation treatment. At the same time, the severity of the pain syndrome decreased by 32.6% in 8 or 10 days in comparison to the control group, and it decreased by 43.8% in 3 weeks.

The correlation is noted between the data on the dynamics of the pain syndrome profile and the data on the dynamics of the restoration of the range of motion in the hip joint. So, if the initial data (in the preoperative period and immediately after the surgery) were practically identical in both groups, in 8-10 days, the range of motion was restored by 33.4% faster in the main group in comparison to the control group; and the range of motion was restored by 52.7% in 3 weeks.

Conclusions

1. The features and characteristics of the pain syndrome were defined before, during, and after rehabilitation in two groups of patients with knee joint disorders; the two groups were identical in sex, age, type of disorder, and type of surgical interventions. The dynamics of the reduction in pain intensity and the rate of recovery of knee joint motions in the main group of patients showed that the method of continuous passive motion using the apparatus for automatic movement workout in the complex physical rehabilitation of patients with knee joints disorders leads to a reduction in the rehabilitation period, an increase in the range of motion on average by 52.7% in the immediate postoperative period (up to 3 weeks after the operation) in comparison to the control group, against a significant reduction in the pain syndrome (by 43.8%).
2. The relevancy and high efficiency were proven for Ukraine-made devices for the automatic workout of joint motions for integrated rehabilitation treatment for patients with hip joint disorders, which allows recommending these devices to be widely introduced in clinical use at various stages of physical rehabilitation in rehabilitation centers, orthopedic and traumatology departments.

FIXATION ABILITIES OF SCREWS OF DIFFERENT TYPES IN METAL OSTEOSYNTHESIS OF MEDIAL FEMORAL NECK FRACTURES

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The metal osteosynthesis method does not lose its relevance in medial femoral neck fractures (MFNF), and it is used along with the hip joint replacement. One of the reasons for this fact is the minimal traumatism and the minimal duration of an metal osteosynthesis operation, which is very important for elderly patients who often have concomitant diseases. Metal osteosynthesis with three spongy compression screws is the most popular among various techniques to fix medial femoral neck fractures (MFNFs). There are numerous academic publications with biomechanical and mathematical rationale for fixing properties and optimal techniques to introduce screws, using finite element method, etc. Some authors performed bench biomechanical studies of osteosynthesis stability, which are the most objective in a narrow range of static loads (Rolik O.V., 1997).

Research objective: Investigating the fixation capabilities of three conventional and cannulated spongy screws in bench conditions on human models of medial femoral neck fractures and substantiating biomechanically clinical recommendations of the optimal methods to perform them.

Materials and methods

The research was carried out on 10 isolated wet and 4 dry specimens of the proximal portion of human femoral bones (in compliance with legal norms for the sampling of cadaver materials). Osteotomy was performed at an angle of 55 to 65° to simulate transcervical medial femoral neck fractures (Pauwels-III). Metal osteosynthesis was performed with three compressive spongious screws of the AO type or cannulated screws, which were tightened with the maximum possible force of 0.8 to 2.0 Nm determined by a specially designed torque screwdriver. The worm-type thread of the screws ended in the proximal femoral fragment.

Conventional screws (Group I) and cannulated maximum long screws (Group II with the k index, e.g., A_k) with a finite thread, which did not pass into a distal end, were inserted subchondrally in the three following options:

A screw: As per the classical scheme: at an angle of 130 to 140°, as a triangle cross section; the lower screw passed tangentially to the Adams arc, and the two upper screws were inserted at a distance of 1 to 1.5 cm above the previous one in the antero- and posterosuperior poles of the femoral head;

B screw: The two screws, the lower and the anterosuperior, were inserted as per the classical scheme; and the third screw was inserted at an angle from the upper trochanteric zone to the posteroinferior cortical layer of the Adams arc, which was preserved near the lower pole of the femoral head as the strongest and osteoporosis-resistant site, wherein the thread was tapped;

C and D screws: The screws are identical to A and B screws on the same specimens, in the previous threaded canals, however, they are used with washers with outer diameter of 10 mm. This technique leveled the loosening of the bone specimen in the clivus area, which was caused by osteoporosis.

Stability of metal osteosynthesis was investigated at the bench for author's design biomechanical research by applying axial step-type increasing static loads to the specimens and additional variable cyclic loads from 5 cycles with 1 Hz frequency and force of 50 to 1000 N. This mode simulated functional load when getting about on crutches without support on the limb and with the metered incremental support. At the same time, mutual displacement of fragments was measured by displacement indicators with an accuracy of 0.01 mm in three planes ("shift", "varus", "dislocation"). The mutual displacement data obtained from each individual indicator and summarized data were statistically processed in Excel. Each option of metal osteosynthesis was tested three times; in total 216 series of measurements were analyzed.

Research findings and discussion

As a result of our research, we found that in Group I:

On wet specimens, which elastic modulus is as close as possible to the clinical conditions: The weakest place is the cortical plate of the greater trochanter, i.e. clivus;

On dry specimens: First, the bone thread is stripped in a spongious tissue of the femoral head. At the same time, the use of washers on wet specimens (B screw option) multiplies the screw tightening force by 1.7-3.2 times, with the screw tightening force reaching the range of 1.4 to 2.7 (2.0 ± 0.7) N·m and multiplying the stability of fixation by 2-2.5 times.

On dry specimens: On dry specimens: The tightening force increases by $30 \pm 17\%$.

In G screw option: When inserting a third screw with a washer into a compact tissue of the Adams arc of the proximal fragment, the tightening force is multiplied by 2-4 times up to 1.4-2.4 N·m. At a static and dynamic load of 1,000 N, on specimens with metal osteosynthesis without using washes (A screw option), the elastic bend "for the varus" was 5.20 mm, the displacement "for the offset" was 8 times less (0.65 mm), and "for the wedging" was 74 times less (0.07 mm). The elastic limit was within the range of 1,300 to 1,400 N, the rupture strength was 2,00 N; in B screw option: The elastic limit and the rupture strength were within the range of 1,500 to 1,600 and 2,300 N respectively.

In Group II, where under the similar conditions of the experiment, on the same specimens: cannulated screws were inserted into pre-formed canals, and the cannulated screws that securely fixed the bone due to a larger diameter; the screws received higher fixation and elastic deformation rates under similar loading conditions. It should be noted that the specimens were re-used not only to save their amount, but they were re-used rather to level out side factors, such as individual degree of specimen mineralization, specimen size, direction of screw insertion, screw lengths, etc. In this case, the screw tightening force increases by 20-30%.

On wet specimens (B_k screw option): when using the washer, the maximum screw tightening force increases to the range of 1.6 to 2.9 (2.4 ± 0.7) N·m, and the fixation stability increases by 30-40%.

On dry specimens: The screw tightening force increases by 38 ± 12%.

In G_k screw option: When a third screw with a washer is inserted into the compact tissue of the Adams arc of the proximal fragment, the screw tightening force increases up to the range of 1.8 to 2.4 N·m.

At a static and dynamic load of 1,000 N:

On specimens with metal osteosynthesis without washers (A_k screw option), the value of the elastic bend "for the varus" was 4.40 mm, the displacement "for the offset" was 0.45 mm, "for the wedging" was 0.05 mm. The elastic limit was within the range of 1,500 to 1,800 N, the rupture strength was 2,400 N; in V_k screw option, the elastic limit and the rupture strength were within the range of 1,600 to 1,900 and 2,800 N respectively.

It is important to note that in Group I and Group II, when using cyclic loads, destabilization of metal osteosynthesis takes place at efforts 30-50% less in comparison to gradually increasing static loads.

Conclusions

1. Deformity of dry and wet specimens with models of metal osteosynthesis is fundamentally different, especially under cyclic loads; so dry specimens may only be used for preliminary evaluation.
2. Metal osteosynthesis for medial femoral neck fractures with three tightening screws ≥ 1 N·m provides a stable fixation when simulating static loads and loads gradually increasing up to body weight, and loads even 1.5-2 times higher than body weight. Under cyclic loads, the fixation stability is reduced by 30-50%.
3. The use of washers significantly increases the screw tightening force and fixation, especially in specimens with reduced mineralization.

4. Inserting a third screw from top downward in the fragment of the Adams arch, which is preserved near the lower pole of the femoral head (B screw option), increases the fixation capability of the metal osteosynthesis, especially in specimens with more pronounced osteoporosis. At the same time, we noted significant difficulties associated with accuracy of inserting the screw.

5. Cannulated screws significantly increase the fixation capabilities of the metal osteosynthesis for medial femoral neck fractures, but due to an increase in the diameter of screw bodies and thread, the metal load onto the bone increases in parallel; therefore, in clinical conditions, it is obviously that using 1 or 2 cannulated screws is appropriate, with the cannulated screws combined with conventional AO type screws.

ASEPTIC NECROSIS OF THE FEMORAL HEAD IN ADULTS. ISSUES OF CONSERVATIVE THERAPY

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Introduction

Aseptic necrosis of the femoral head is a severe disease of the hip joint. The disease affects mainly the working age male population; its course is long, and eventually it leads to disability.

The etiology and pathogenesis of aseptic necrosis of the femoral head are still unclear.

Currently, an increasing number of authors adhere to the polyetiological theory; according to this theory, aseptic necrosis is recognized as a disease caused by a variety of common and local causes.

We are more often confronted with idiopathic aseptic necrosis of the femoral head. Lack of information about the etiology and pathogenesis of idiopathic necrosis and the difficulty of its early diagnosis complicates the organization and application of preventive measures, and reduces the efficiency of conservative and, sometimes, surgical treatment.

The clinical manifestations and diagnostics of aseptic necrosis of the femoral head is difficult at early stages, with diagnostic errors often occurring.

There are some reasons for poor and late diagnostics of idiopathic aseptic necrosis. Among them: latent and gradual onset of the disease, lack of clear pathognomonic symptoms, features of pain syndrome, and a long-term preservation of mobility in the joint.

Research objective: Analysing our own experience of conservative treatment of aseptic necrosis of the femoral head. Determining the optimal treatment tactics for aseptic necrosis of the femoral head to improve the results of its conservative treatment, and to delay the time of surgical intervention

Materials and methods

In 2014-2016, 65 patients conservatively treated for aseptic necrosis of the femoral head confirmed with X-ray, CT, and MRI, were under our follow-up. Male population prevailed among the patients followed up: 5 persons aged 19 to 20 years, 19 persons aged 21 to 35 years, 27 patients aged 36 to 50 years, 9 patients aged above 51 years, and 5 women aged 45 to 57 years.

13 patients had stage I; 39 patients had stage II; and 13 patients had stage III of aseptic necrosis of the femoral head, with 5 female patients suffering from coxarthrosis among them. All the patients before treatment in clinic were treated for coxarthrosis in community outpatient clinics. The results are weak

positive. We proposed an integral symptomatic therapy, taking into account the etiology and pathogenesis of the disease.

Proposed by State Institution "Professor M.I. Sitenko Scientific Research Institute of spine and joint diseases" under National Academy of Medical Sciences of Ukraine, Kharkov, Ukraine, the integral symptomatic therapy for aseptic necrosis of the femoral head was taken as basic.

The treatment began with strict adherence to the orthopedic regimen. Patients with stage I were limited to walking with a cane or crutches, while patients with stages II and III underwent necessarily unloading traction with a weight of 3 to 5 kg, and walking with a cane.

Pharmacotherapy included drugs that improve vascularization of the femoral head and microcirculation (pentoxifylline intravenously followed by enelbin), L-lysine escinate to relieve swelling of the soft tissues of the musculoskeletal system, which was accompanied by local circulatory disorders and pain. The treatment included obligatory vitamin E and vitamins of B group, and drugs containing calcium (preference was given to "osteogenon"). For the prevention and treatment of joint contractures, the vitreum was used.

To reduce the intensity of pain, the treatment of aseptic necrosis of the femoral head included obligatory transcutaneous electroanalgesia carried out in accordance with certain parameters as a method of pathogenetic therapy.

The following physiotherapy procedures were added to the integral treatment: massage, exercise therapy, warm baths (36-37°C): salt and conifer baths, and sea salt baths. It made it possible to improve both venous and arterial the blood circulation, to eliminate venous stasis, relieve pain, slow down the development of muscular atrophy, and increase the range of motion in the affected joint. Nonsteroidal anti-inflammatory drugs were administered only in the presence of coxarthrosis no more than for 3 days.

Research findings

We noted an improvement in 85% of cases after treatment (pain reduction, increased range of motion in the hip joints, improved support and walking function). Patients with stages I and II showed remission for a period of 10 to 12 months. They came to the second treatment course a year later. Conservative treatment was less effective in patients with stage III, but a positive dynamics was observed in 9 of 13 patients: a decrease in the intensity of pain and a slowdown in the progression of the pathological process. Restoration of the bone structure of the femoral head was not observed, but the destruction did not expand. 7 patients with stage III came to clinic again, underwent another course of treatment in six months. 3 patients (2 of them were women) were operated 6 in months after the treatment received on our clinic.

Conclusions

Conservative treatment is indicated for patients with aseptic necrosis of the femoral head at stages I and II of the disease, which do not have pronounced clinical and radiological manifestations of the process, with a "favorable" course of the disease and slowly progressive forms of the disease. Conservative treatment of aseptic necrosis of the femoral head should be integrated, including joint unloading, transcutaneous electroanalgesia, pharmacotherapy with the mandatory use of enelbin, vitamin E and vitamins of group B, osteogenone and vitreum. Other drugs and therapeutic measures complemented the main vectors of conservative therapy of aseptic necrosis of the femoral head.

With the observance of the treatment, one may attain stable remission and vocational rehabilitation at stages I and II of the process for 1 or 2 months. Stage III implies a longer treatment time, the remission is shorter, but such indicators also make it possible to postpone the time of surgery to a later date, which is important today from both an economic and psychological point of view.

Reference list

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FORECASTING THE CONSEQUENCES OF THE INFLUENCE OF HIGH-ENERGY INJURY OF DISTAL END OF LOWER EXTREMITIES

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Introduction

The incidence of the distal tibia fractures is within the range of 1% to 30% among fractures of all other localizations and up to 10% among all tibia fractures. The fractures are more often comminuted and intraarticular; they are accompanied by significant alteration in blood flow in the soft tissues surrounding the fracture. Various criteria are taken into account in these injuries: the energy of trauma, the severity and localization of the injury, transient ischemia, etc. (Gayko G.V. *et alii*, 2015). The choice of the best diagnostic methods and the subsequent treatment of the injuries and their complications are a rather problematic issue so far.

Research objective: Determining the scope of the necessary clinical and diagnostic tests for further prediction of complications, and the choice of the optimal treatment tactics.

Materials and methods

The treatment of 128 patients with distal tibia fractures was analyzed. The patients consisted of predominantly male population (87-68%) of the most able-bodied age (the average age was 42 years).

Diagnostic measures in the group of patients with closed fractures compulsorily included the following: assessment of the soft tissues condition (presence and severity of edema), comparative ultrasound diagnosis of fascial compartments and radiography in two standard views. Computer tomography was carried out to assess the degree of bone lesion, to determine the number of major fragments and their removal, as well as the severity of the lesion of the tibial articular surface. When establishing a clinical diagnosis, AO classification of fractures was used.

Research findings

The patients were divided as per the fracture type: A type (24 persons), B type (28 persons), and C type (76 persons). To assess the severity of the injury, the scale of prediction of possible consequences was

used, with the scale containing data on the injury nature, first aid, scope and characteristic of the dynamic treatment administered.

In closed fractures of the limbs (106 patients), the patients had a marked pain syndrome and edema. Subepidermal blisters (flicktenas) were observed in 72 patients, which were attributed to characteristics of the traumatic factor received, first aid disadvantages and late presentation. After adequate pharmacotherapy therapy (within a period of 3 days to 3 weeks), surgical intervention (stable osteosynthesis) was performed. In open bone fractures (22 patients), external fixation devices were preferred, which were used in 14 cases to temporarily fix the bone fragments before healing the primary wound; it was disassembled later on and followed by periosteal osteosynthesis. This tactic was due to lack of the possibility to accurately reduce fragments by means of extrafocal osteosynthesis, and because of the development of contracture when using schemes with fixation of the ankle joint. The tactics of emergency submersing subcutaneous osteosynthesis statistically did not justify itself because of postoperative complications attributed to the high risk of infection in case of certain defects of surrounding soft tissues.

The results of treatment, which were mostly consistent with the prognosis in accordance with the scale, were evaluated as good in 110 patients (86%), satisfactory in 14 (11%) patients, and unsatisfactory in 4 (3%) patients. The latter were re-operated due to the non-union of the fracture with the formation of false joint (2) and osteomyelitis (2), and currently they are under treatment.

Conclusions

1. Prognosis of complications and the choice of the optimal treatment tactics should be individual, depending on the data of a thorough dynamic assessment.
2. Using a score scale to assess the injury of the distal tibia allows optimizing the process of predicting the effects of treatment.

ORGANIZATIONAL ASPECTS OF THE REHABILITATION PERIOD IN GERONTOLOGICAL PATIENTS WITH PROXIMAL FEMUR FRACTURES

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Introduction

Under conditions of aging population of Ukraine, the proximal femur fracture is one of the medical and social challenges, which significantly affects the quality of life of very old people. The femur fractures incidence is within the range of 15 to 45% of injuries of the musculoskeletal system, with the femoral neck fractures making up to 50-55% among them.

Methods of surgical treatment for the femoral neck fractures require careful preoperative preparation, which does not always allow for surgical intervention in patients with severe concomitant diseases because of high risk of complications even in case of good quality of the preoperative preparation. Even if surgical intervention is performed, these patients require a long rehabilitation period. Known methods of conservative treatment for patients with femoral fractures are associated with a prolonged

bed rest or with the use of immobilization. With this regard, organization of a rehabilitation period in gerontological patients is increasingly important.

Research objective: Developing procedures of rehabilitation care for medical and social adaptation of gerontological patients with injury of the proximal femur.

Materials and methods

Anonymous questionnaire was carried out among students of various courses of the State Higher Educational Establishment “Ukrainian Medical Stomatological Academy”, Poltava (102 persons), and V.G. Korolenko National Pedagogical University, Poltava (153 persons), for conscious participation of students in the group organized to provide individual advisory assistance to injured persons.

The vast majority of questions in the questionnaire included options of alternative types of responses and allowed an analysis of the general attitude of certain categories of young people towards participation in social projects involving the ageing and elderly.

Research findings

The results of the student questionnaire differed, depending on the future profession chosen by them and the length of stay in the higher institution establishment.

Future doctors and educators who have expressed a desire to participate in a social project were involved in the work of a public organization. The organization has a principle of vertical subordination. The work is carried out by supervisors of different levels with appropriate training, education and legal authority. The organization is headed by a traumatologist-orthopedist doctor with sufficient experience in working with patients of this category. His duties are to arrange and hold the general meeting of all the supervisors conducting briefings, collecting and analyzing the results of the organization activities and further conclusions and suggestions to improve work.

The functions of direct performers when visiting the patient for the first time include the registration of the patient as per the record developed to follow up patients. The record includes a patient’s anthropometric data, a clear diagnosis as per the written epicrisis from the medical record or other medical documentation, the data on the surgical intervention carried out or its absence, the presence of concomitant diseases in accordance with patient's outpatient hospital record, etc. A prerequisite for further work with a patient is the presence of an orthopedist traumatologist at the first visit, which subsequently approves a rehabilitation plan after agreeing it with a family doctor. The indicated scheme was approved for the control of 711 patients.

Conclusion

Involving students in the provision of rehabilitation assistance to gerontological patients is beneficial for patients, medical institutions, and for the students themselves from vocational point of view.

USING COMBINED OSTEOSYNTHESIS IN COMMUNUTED FRACTURES OF THE PROXIMAL HUMERUS

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Introduction

A large number of studies were carried out concerning issues of the proximal humerus fractures; and their results do not give us a clear answer about choosing a surgical treatment method: bone replacement or reconstructive osteosynthesis.

Research objective: Improving the results of treatment of comminuted fractures of the proximal humerus by developing a system of integrated treatment based on the restoration of both anatomical integrity of the humerus and the tendons and capsules of the shoulder joint, taking into account the structure of the fracture and the anatomical aspects of this segment. Thus, the development of avascular necrosis of the humeral head may be prevented; the range of motion in the shoulder joint may be restored; the posttraumatic arthrosis of the shoulder joint may be reduced; the period of patients' disability may be reduced as well as the disability percentage.

Materials and methods

The study group consisted of 87 patients with a the proximal humerus fracture. 46 patients had three-fragment fractures; 13 patients had three-fragmental fractures with dislocation of the articular surface of the humeral head; 18 patients had four-fragment fractures; and 10 patients had four-fragment fractures with dislocation of the articular surface of the humeral head. This type of fracture in all patients was accompanied by rotation of more than 45° and a diastasis of more than 1 cm between the bone fragments. Patients aged 16 to 83 years (their average age was 49.5 years). The study group included 38 men and 49 women. All the patients were operated by using author's two-stage osteosynthesis method (patent for utility model No. 88435 registered in the State Register of Patents of Ukraine for utility models on 11/03/2014); the method included the stages as follows:

Stage 1: Restoration of congruence of the articular surfaces; achievement of the shoulder joint dynamic stability by using transosteal fixation of bone fragments; restoration of tendons and capsules of the shoulder joint, and its reinsertion; suture of defects that appears because of the use of anchor fixators (elastic fixation);

Stage 2: Hemopoietic osteosynthesis with a plate with screws locked in it (hard fixation).

Research findings and discussion

To determine the function of the upper limb, the Constant-Murley score was used. The follow up period was within the range of 1 month to 1 year after the surgery. Excellent and good results were obtained in patients with three-fragment fractures and proximal humerus fractures. Satisfactory results are obtained in patients with four-fragment fractures. Unsatisfactory results were obtained in patients with four-fragment dislocation fractures. The negative treatment results were in 7 patients with avascular necrosis of the humeral head; in 2 patients with hematoma suppuration and synovial fistulas in the postoperative period; and in 1 patient with migration of metal constructions, which occurred when the patient had epileptic seizures.

Conclusions

The elastic fixation (Stage 1 of osteosynthesis) provides the opportunity to achieve dynamic stability due to a tight contact between the bone fragments and a simultaneous restoration of the tendons and the capsule of the shoulder joint. Extracortical osteosynthesis with a plate and screws blocked in it (Stage 2 of osteosynthesis) provides stiffness for bone fragment fixation.

Positive treatment results suggest the possibility of use the osteosynthesis method developed as a method of primary selection in comminuted fractures of the proximal humerus.

REGENERATIVE TECHNOLOGIES IN TREATMENT OF DEGENERATIVE JOINT DISEASES AND BONE DEFECTS

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In 1908, the "stem cell" term was first heard, and in the early 1950s, the first experiments on the practical use of stem cells were carried out. Currently, mesenchymal stem cells (MSCs) are widely used in orthopedics for accelerated regeneration of bone, cartilage, and other related tissues.

The research is underlain by 15 patients with deforming arthrosis, false joints, and bone defects, which were treated at Virtus Institute of Aesthetic and Plastic Surgery and in Odessa Regional Clinical University Hospital within a period from from 2010 to 2016.

Research objective: Development of regenerative therapy by using mesenchymal stem cells with PRP technology; clinical and radiological evaluation of its efficiency

To determine the appropriate PRP therapy regimen and evaluate the efficiency of the regenerative therapy, the following diagnostic methods were used: CT, MRI, densitometry, duplex study.

The procedure of MSCs application in combination with PRP is as follows:

- Sampling bone marrow for MSCs and simultaneous PRP therapy in the pathological zone;
- In 2 weeks: re-administration of PRP therapy;
- In 2 weeks: control of revascularization of the pathological zone filled with MSC grown in the laboratory on the skaffold with PRP therapy.

Conclusions

Using the culture of MSC and PRP therapy is a promising recovery method for:

- comprehensive bone in the zone of false joint;
- the most promising method to restore large cartilage defects.

When using the culture of MSC, concentration, method of delivery to patient's body, and multiplicity of manipulations are determined individually for each patient by specialists (doctor traumatologist-biotechnologist).

The data obtained suggest a positive effect of the technique on reparative chondro- and osteogenesis. It gives us reasons to offer the use of MSCs and PRP therapy in injuries of joint cartilage and bone defects.

MISTAKES AND THEIR CONSEQUENCES AFTER IMPLANTATION OF THE ACETABULAR COMPONENT OF THE HIP JOINT IMPLANT

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The total hip joint replacement refers to high-tech surgical interventions and requires compliance with the necessary requirements; non-compliance with these requirements may lead to complications even in early postoperative period, and to joint instability in the further, and as a consequence, to a revision joint replacement. Therefore, it is necessary to follow the optimal technique of surgical intervention, which includes a good implant configuration, soft tissue balance, and adequate surgical tactics (Dargel J., Bruggemann G., Eysel P., 2014).

Mistakes arising in hip joint replacement are distributed to patient-dependent, implant-dependent and surgeon-dependent (Gaiko G., Kalashnikov Al., Sulima A., Nizalov T., 2015).

Most often mistakes are made by the surgeon when replacing the hip joint in elderly patients because of a lower muscular tone, in dysplastic coxarthrosis and congenital hip dislocation, in protrusion and hyperplastic coxarthrosis, and in ankylosis in the hip joint.

The main requirement to the implantation of the acetabular implant component is to establish it in the anatomical position of the acetabulum with respect to spatial orientation, namely: abduction of 40 to 45° and anteversion of 10 to 15° with sufficient overlapping it with bone tissue. One of the common mistakes is the non-compliance with the requirements to the acetabular component, i.e. abduction and anteversion. This mistake may lead to dislocation of the implant even in the early postoperative period. According to academic literature on the subject, implant dislocation in primary hip joint replacement is observed in 1 - 4% of patients (Charnley J., 1979; Von Knoch *et al.*, 2002; Gaiko G., Kalashnikov Al., Sulima A., Nizalov T., 2015, Filipenko VA, Tankut VA, Mezentsev VA, Ovchinnikov AM, 2017).

Non-compliance with the acetabular component often occurs in hip joint replacement in patients with dysplastic coxarthrosis and congenital hip joint dislocation. To achieve a sufficient overlap of the acetabular component with bone tissue and to facilitate the adjustment of the acetabular implant component, a greater angle of inclination is often established. According to the data provided by Zagorodniy N.V. *et alii*, 2012, the wearing of the acetabular implant component when it is tilted at an angle of 50° is 16.5%, and when a tilt increases up to 56°, the wearing increases up to 23.2%, which accelerates the destruction of the acetabular implant component.

The implantation of the acetabular component in the anatomical position of the acetabulum is also important, which is necessary for the restoration of the biomechanics of the hip joint; moreover, the acetabulum has the largest stock of bone tissue necessary for stable fixation of the acetabular component.

At the same time, in dysplastic coxarthrosis, the acetabular component is often placed into the anatomical position of the acetabulum, and in congenital hip joint dislocation, some authors recommend the acetabular component to be placed in the site of a new acetabulum.

In hypertrophic coxarthrosis, osteophytes are sometimes taken as the acetabulum margin, and the acetabular component is not sufficiently immersed in the bone tissue. While in protrusive coxarthrosis, the acetabular component, on the contrary, is considerably deepened into the bone with possible injury of the terminal plate of the acetabulum, which subsequently leads to protrusion of the acetabular component into the pelvis.

In hip joint ankylosis, especially in patients with ankylosing spondylitis who have a deformity of the spine with a fixed deformity of the pelvis, it is difficult to determine the guidelines for the correct placement of the acetabular implant component. In such cases, it is necessary to carry out X-ray control on the operating table.

Thus, the main reason for the correct implantation of the acetabular component in the total hip joint replacement is preoperative planning and adequate surgical tactics while meeting the requirements to the position of the acetabular implant component.

TACTICS OF TREATMENT OF BONE LESION IN LYMPHOGRANULOMATOSIS

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Introduction

The incidence of bone lesion in lymphogranulomatosis (LGM), according to various researchers, oscillates within the range of 4.5 to 58%. The greatest number of bone lesions in LGM occurs in the age of 20 to 40 years. Bone lesion in LGM is predominantly a secondary process, due to the proliferation of the process from soft tissues and lymph nodes to the bone. Secondary bone lesions in LGM appear at different times after the onset of the disease, usually in a period of 1.5 to 2.5 years, and usually at stage IV of LGM. According to academic literature on the subject, in LGM pelvic bones are affected in 18.9% of cases, while tubular bones affected in 9.24% of cases.

Research objective: Showing the possibility of treatment of bone lesion in lymphogranulomatosis.

Materials and methods

Under our supervision, there were 5 patients with lymphogranulomatosis, Stage IV, after a courses of polychemotherapy, with a relapse of disease. The diagnosis was established on the basis of medical history, histological and immunohistological data. In these patients, single bone lesions were observed. X-ray and computer tomography data showed that the affected bone had pathological changes, such as destruction of the bone structure or sclerosis. Sclerotic areas of various sizes and shapes were observed in the head, trochanter, and intertrochanteric zone of the femur in 3 patients, and the degeneration zones in the pelvic bones were observed in 2 patients. A local pain was the main clinical symptom in bone lesions in patients with LGM. Patients received radiation therapy (RT) with the total radiation dose (TRD) of 40 to 60 Gy for focal lesions in the bones and intravenous bisphosphonates (pamidronate or zoledronic acid); in addition, the patients continued receiving polychemotherapy courses. The treatment results were evaluated clinically and by means of X-ray or computed tomography.

Research findings

In the course of treatment, the patients noted the disappearance or reduction of pain in the affected bone, temperature reduction, restoration of the range of motion in the hip joint. In 3 patients, after the radiation therapy applied to the affected area of the femur, despite a satisfactory clinical outcome, control X-ray examination and computer-tomographic examination did not reveal any changes in osteosclerotic lesions in the femoral bone compared to the initial data (before treatment). The bone

reparation with marginal osteosclerosis was radiologically noted in 2 patients with areas of degeneration in the pelvic bones after the radiation therapy. No progression of bone lesions was observed for 3 years in all the patients with LGM and bone lesions by means of X-ray and CT-tomography in dynamics after the radiation therapy.

Conclusions

Using radiotherapy in relapses of LGM with bone lesions in combination with bisphosphonates and polychemotherapy allows reducing the pain syndrome, prevents the development of secondary complications, such as pathological fractures, and improves the quality of life of patients. Radiation therapy in bone lesions in patients with LGM is the main method of treatment, which in most cases makes it possible to achieve a long remission.

RESULTS OF JOINT REPLACEMENT IN PATIENTS WITH METASTATIC BONE TUMORS

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Introduction

Metastatic lesion of the skeleton is a serious problem for patients with a disseminated tumor process. This type of lesion, as a rule, is accompanied by acute prolonged pain, depletes the patient, and leads to a significant deterioration in the quality of life. Surgical treatment, which is a palliative method in a combined therapy of bone metastases, plays an important role in patients' adaptation and facilitates certain manipulations. Using combined and comprehensive treatment methods, which may significantly improve the quality of life of these category of patients, underlies modern approaches to the treatment of metastatic bone tumors. Currently, surgical methods in the world orthopedic oncology include joint replacement, intramedullary and extracortical osteosynthesis, curettage of tumors with the use of bone cement, percutaneous non-focal osteosynthesis, and stabilizing surgical interventions on the spine.

The joint replacement is almost always justified and is a method of choice in the case of metastatic lesion of the articular segments of the bone. When choosing the joint replacement method in patients with malignant neoplasms with metastatic lesions of the skeleton, one should take into account the general condition of the patient, the type of tumor and its radiosensitivity, the stage of the process, including the average life expectancy of the patient, pre-treatment, neurological status, time passed after the appearance of the first symptoms of skeletal lesions, and dissemination of the skeletal lesions.

Research objective: Showing the possibility of joint replacement in metastatic bone lesion.

Materials and methods

Joint replacement for metastatic tumors of long bones was carried out in 32 patients within a period from 2009 to 2017. The histological type of the primary tumor was as follows: kidney cancer in 11 cases, breast cancer in 10 cases, lung cancer in 7 cases, prostate cancer in 2 cases, colon cancer in 1 case, and thyroid cancer in 1 case. Joint replacement was performed: hip joint replacement in 17 patients, shoulder joint replacement in 7 cases, elbow joint replacement in 3 cases, humeral bone diaphysis replacement in 3 cases, femur diaphysis replacement in 1 case, and knee joint replacement in 1 case. In the preoperative period, all the patients received a course of radiation therapy with the total radiation

dose (TRD) of 40 Gy for focal lesions in the bones. After the surgical treatment, patients received polychemotherapy, hormonal therapy, immunotherapy, bisphosphonates, and radionuclides in the integrated treatment regimens. The functional result of the limb after joint replacement was determined by the MSTS system. The quality of life of the patients before and after joint replacement was determined by the EORTC QLQ-C30 questionnaire. Survival rate of patients was analyzed by Kaplan-Mayer method.

Research findings

Postoperative complication incidence was 12.5%, tumor recurrence was 6.25%. Evaluated as per the MSTS system, the functional results of the limb after the hip replacement were 72.6%, after shoulder joint replacement 66.4%, after elbow joint replacement 88.8%, after replacement of shoulder bone diaphysis 90.4%, after replacement of femoral bone diaphysis 86.2%, and after knee joint replacement 84.2%. Quality of life of patients (as per questionnaire EORTC QLQ-C30) improved from 30 scores (in the preoperative period) to 80 scores (after joint replacement). A three-year overall survival rate of patients was $26.4 \pm 0.86\%$, while a five-year overall survival rate of patients was $13.5 \pm 1.42\%$.

Conclusions

Joint replacement as a method of surgical treatment of bone metastases in integrated treatment regimens, which include radiotherapy, polychemotherapy, hormone therapy, immunotherapy, bisphosphonates, and radionuclides, contributes to restoration of the limb function and improve the quality of life of this category of patients.

POSTOPERATIVE REHABILITATION OF PATIENTS WITH EXCESSIVE LATERAL PATELLAR COMPRESSION SYNDROME

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Introduction

Currently, osteoarthritis is one of the most common diseases of the musculoskeletal system. Over the past decades, an increase in the number of patients with osteoarthritis incidence increasing from 19.8% to 63% and the knee osteoarthrosis being within the range of 51.6 to 72.0%. It indicates both a medical and a social problem. Congenital knee dysplasia is one of the causes of gonarthrosis in young and adult age.

Research objective: Providing clinical and physiological substantiations of integrated physical rehabilitation of patients with dysplastic deformities of the knee joint.

Research method

Analysing special academic literature on the issue of using physical rehabilitation equipment for dysplastic deformities of the knee joint.

Research findings

There are various forms of dysplastic deformities of the knee joint that contribute to the development of dysplastic gonarthrosis: aplasia (of patella); hypoplasia (of medial patella facet, medial femoral processes, and tibia); hyperplasia (medial femoral process), etc. Dysplastic deformities of the knee joint are characterized by polymorphism of dystrophic changes in soft tissue and bones and clinical

symptoms. In either case, the researchers found that the dysplastic process affected all the elements of the knee joint and included underdevelopment of the soft tissue components of the joint (capsuls, ligaments and meniscus), dysplastic changes in the femoropatellar articulation, and dysplastic deformities of the tibio-femoral joint. According to observations of scientists, these dysplastic changes are often combined with each other. The most common forms of dysplastic deformities of the femoropatellar articulation are as follows: hyper valgisation of the tibial plateau bone surface roughness, hypoplasia-aplasia of the processes of the femoral block, hypoplasia-aplasia of the medial patellar facet, and high placement of the patella.

One of the treatment options for dysplastic forms of knee joint deformities is surgical; it may include: ligament plastics that may support the patella; transposition of tibial plateau bone surface roughness; correcting bone plastics of the femoral block and the patella plate; restoration of microcirculation, removal of bone tension (tunneling, spongialization); optimization of the reparative process in the focus of the articular cartilage; and their combination. Regardless of the type of surgical intervention, the last important stage after reconstructive operations on the knee joint extensor is a competent postoperative rehabilitation.

One of the important principles of rehabilitation of knee joint injuries is the integrated use of all physical rehabilitation facilities, taking into account the localization, the nature of the disease and the periods of the disease after arthroscopic operations or open interventions. Restoration surgery of the knee joint begins at the inpatient stage of rehabilitation and continues at the outpatient (sanatorium) stage and at the dispensary. The following therapeutic measures are fundamental at all stages of rehabilitation: physical exercises, therapeutic massage, physiotherapy, kinesiohydrotherapy, labor therapy, which contribute to the restoration of the functions of the knee joint. Physical exercises affect both different systems of patient's body and separate groups of muscles of the lower limbs and joints, making it possible to restore strength, speed and endurance. All exercises are divided into general and special.

General exercises are aimed at the improvement and strengthening of the whole body, special exercises are aimed at that part of the musculoskeletal system whose movements are limited or require a special approach to restore its functionality.

The physical exercises act to patient's body through the interaction of the nervous and humoral systems and motor-visceral reflexes. Physical exercises activate nervous processes; stimulate the emotional sphere, activity of cardiovascular and respiratory systems, metabolism, digestive and excretory systems; accelerate blood and lymph circulation; improve trophic processes in muscles of the knee joint; reduce inflammatory processes; and activate tissue metabolism in articular cartilage. Physical exercises cause neuroreflectory and neurohumoral effects on the whole organism, which is manifested as a tonic and trophic action; physical exercises form a temporary or permanent compensation, normalize the function of the joints.

When restoring the function of the knee joint, all physiotherapeutic exercises can be divided as per anatomical signs, the nature of muscle contraction (dynamic and static), exercise activity (active and passive exercises), the nature of the methodical orientation (respiratory exercises, corrective exercises,

coordination exercises, balance exercises, ideomotor exercises, exercises with support and loading, etc.); and as per the use of gymnastic apparatus and equipment.

Therapeutic massage is widely used in the integrated treatment of patients after surgical operations on the knee joint; it significantly reduces the intensity of drug therapy. Massage is well combined with physical exercises and physiotherapy.

The three following factors play the leading role in the mechanism of action of therapeutic massage on a patient's body: neuroreflexory, neurohumoral and mechanical. Under the influence of irritation in the skin caused by massage, various highly active substances are formed, such as histamine, acetylcholine, amino acids, polypeptides, etc., which are involved in the transfer of nerve impulses and in the regulation of vascular tone. These active substances are formed under the influence of mechanical action; then they penetrate into the blood and lymph, and spread throughout the body.

Therapeutic massage is used at all stages of medical rehabilitation in the integrated treatment of all diseases and injuries. However, despite its versatility and effectiveness, there are a number of contraindications to use of massage depending on the health condition, the form, stage of patient's disease and individual characteristics.

Physiotherapeutic methods of treatment are widely used in restorative therapy at all rehabilitation stages. It is physical factors that contribute to the restoration of articular cartilage and have no side effects to patient's body. They affect blood and lymph circulation, vascular tone, microcirculation processes, enzymatic activity, tissular metabolism, joints, muscular and ligament apparatus, accelerating the restoration of impaired functions. Physical factors increase muscular tone, prevent joint stiffness and deformity, have anti-inflammatory, trophic, analgesic, and regenerative effects. Physiotherapeutic factors act on patient's body through the skin, mucous membranes, and respiratory tract by irritating their numerous receptors.

Integrated use of various physical rehabilitation methods (exercise therapy, therapeutic massage, physiotherapy, hydrocolonotherapy and mechanotherapy) allows full restoration of the supporting and motor functions, as well as professional fitness.

Conclusions

One of the important principles in the treatment of excessive lateral patellar compression syndrome is the integrated use of all physical rehabilitation equipment, which is the basic method at all stages of rehabilitation for patients after knee surgery. After the surgery for dysplastic changes in the knee joint, therapeutic exercises, massage, and physiotherapy should be prescribed at the following periods: early postoperative, late (functional), and training-recovery periods. Integrated use of physical rehabilitation (therapeutic exercises, therapeutic massage, physiotherapy, hydrocolonotherapy and mechanotherapy) allows full restoration of the supporting and motor functions, as well as professional fitness.

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EXPERIMENTAL MODELING OF BURST FRACTURES OF THE THORACOLUMBAR SPINE

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Introduction

Blust fractures of the lower thoracic and lumbar spine are the most common among all spinal injuries, with their incidence being within the range of 20 to 40% of all its injuries according to various authors. All blust fractures differ in polymorphism and variety of clinical forms. Accordingly, the polymorphism of injuries determines the possibility of various types of deformities of the thoracic and lumbar spine.

Research objective: Studying the biomechanical characteristics of *kyphotic deformity*, which develops under the influence of axial compressive load acting along the entire spine, depending on the degree of injury of the vertebral segments.

Materials and methods

The subject of this study is the physical model of the blust fracture of the Th12 vertebral body. The physical model was made on anatomical specimens of the blocks of vertebral segments of the animal (pig).

The experiment was carried out on two anatomical specimens with a phased (4 stages-4 groups) destruction of the spinal structures. The first group was represented by vertebral segments with preserved bone and ligaments (Group I - norm). In the second group, up to 50% of the vertebral body was destroyed in the model, including its posterior portion and one adjacent intervertebral disk (Group II – destruction of 50% of the vertebral body). In the third group, the whole vertebral body (100%) and two adjacent disks (Group III - 100% of the vertebral body) were destroyed in the model. In the fourth group, the vertebral body was destroyed (100%), as well as disks, arcs, ligaments, and joints (Group IV - 100% of the vertebral body + disks + joints + ligaments).

Experimental studies were carried out on the basis of the biomechanical laboratory of State Institution "Professor M.I. Sitenko Scientific Research Institute of spine and joint diseases" under National Academy of Medical Sciences of Ukraine, Kharkov, Ukraine. The vertical axial load was modeled on anatomical specimens. The load was modified by steps, ranging from 0 to 500 N, with a load step being 50 N. The axial compression was recorded at each load level.

Research findings and discussion

In Group I, compression of the specimen did not exceed 0.15 mm at a minimum load of 50 N. The specimens of Group II, which had the destruction of 50% of the vertebral body and 1 disk, had compression up to 0.78 mm at this load; compression increased up to 1.5 mm (Group III) at further destruction of the vertebrae up to 100% and 2 disks. A rather noticeable increase in the change in compression was observed in specimens of Group IV: up to 2.3 mm in specimens with additionally destroyed joints, and up to 3.1 mm in specimens with additionally destroyed ligaments.

The results of our dispersion analysis showed that the magnitude of the axial compression of specimens with different degrees of injury is different, with the difference being statistically significant. When the load is 50 N, an increase in axial compression, which is directly proportional to the degree of destruction, is determined.

The maximum modulus of elasticity of (84.7 ± 14.8) MPa was obtained in undestroyed specimens at the minimum load of 50 N, while modulus of elasticity of an undestroyed specimen differed from the total deformation modulus of the specimens with destroyed vertebral bodies, with the difference of less than 4.5 times being statistically significant: (18.1 ± 2.52) MPa (destruction of 50% of the vertebral body) and (12.0 ± 0.97) MPa (destruction of 100% of the vertebral body). The total deformation modulus of those specimens differed from that of specimens with additionally destroyed joints (4.5 ± 0.2) MPa and ligaments (2.7 ± 0.2) MPa, with the difference being statistically significant.

When the load increased up to 100 N, the maximum values of axial compression of 3.52 to 3.76 mm were noted in undamaged samples. The destruction of vertebral bodies and other structures led to an increase in axial compression. In specimens of Group II, the value of axial compression increases, but to its minimum value of 0.48 mm. Further use of the load of 100 N in Group III led to an increase in the axial compression up to 1.2 mm, and in Group IV up to 2.5 mm. Thus, the axial compression was (0.48 ± 0.08) mm in the group with the destruction of 50% of the vertebral body and one disk.

The axial compression was on average (1.88 ± 0.10) mm for specimens with 100% destroyed vertebral bodies, 2 disks, and joints; and (2.98 ± 0.18) mm for specimens with additionally destroyed ligaments. At the same time, under the influence of loading, the magnitude of the deformation of specimens with partially destroyed vertebral body and disk, as well as completely destroyed vertebral body and 2 disks (but with preserved joint and ligaments) keeps on changing linearly up to (5.83 ± 0.22) mm and (6.79 ± 0.44) mm, respectively.

Under the effect of a load of 100 N, undestroyed samples are characterized by a low level of the total modulus of deformation of (28.9 ± 0.5) MPa. The samples with a lesion of 50% of the vertebral body and the overlying intervertebral disc have the total modulus of deformation of (15.1 ± 2.5), with the increment of the total modulus of deformation value being statistically significant, which contradicts the principle of proportional reduction in the total modulus of deformation as function of the severity of the destruction of the spinal segment. The total modulus of deformation of the remaining samples collectively differs from the first two types of samples (with the difference being statistically significant), and this indicator is directly proportional to an increase in the degree of lesion of the samples (Group III — 9.29 MPa; Group IV — 5.79 MPa). The phenomenon of a sharp change in axial compression from 3.76 mm to 0.48 mm in Group II and, accordingly, a change in the total modulus of deformation from 28.9 MPa to 15.1 MPa, is due to the sagging of the damaged structures of the spine at a load of 100 N and at the destruction of 50% of the vertebral body and the overlying intervertebral disk. Thus, a residual deformation developed, which was not eliminated after unloading. Further increase in the total modulus of deformation is represented by its “elastic constituent”.

Further increase in the load up to 150 N was sufficient to compress as much as possible the specimens with completely destroyed structures, and a further increase in the load to 200 N practically failed to change their axial dimensions.

An increase in the load up to 250 N leads to the appearance of plastic deformation in specimens with completely destroyed rear structures. Specimens with a non-destroyed rear structures may withstand a load of 250 N with axial compression of (4.93 ± 1.21) mm, all other specimens change linear

dimensions approximately in the range of 6.56 mm to 8.64 mm, and the more is the lesion, the greater is the linear change in the specimen length.

Conclusions

1. When increasing the scope of destruction of Th12 vertebral motor segment, the magnitude of axial compression of the model increases under the action of any compressive loads, with the increase being statistically significant.
2. Depending on the degree of destruction of the Th12 vertebral motor segment, the total modulus of deformation of the model is reduced due to the loss of the support function of the vertebral segment elements;
3. Depending on the lesion degree and the magnitude of the load applied, both elastic and plastic deformations occur. The model strength failed at the stage of destruction of 50% of the vertebral body and the overlying intervertebral disk at a load of 100 N. As a destruction degree increases, the specimen loses its ability to withstand increasing loads, which is confirmed by a decrease in the total modulus of deformation of the specimens under study.

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MODELING OPTIONS OF TRANSPEDIKULAR FIXATION OF THORACIS SPINE IN RESECTION OF ONE / TWO / THREE VERTEBRAE

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Introduction

Pathological vertebral fractures are the most difficult complication of the tumoral process, which significantly impairs patient's quality of life. The most common cause of neurological disorders is compression of the spinal cord by bones and ligaments of the spine in pathological fractures, and spine deformation, or a direct effect of a tumoral tissue on the spinal cord. An important feature of the surgical stage of treatment is elimination of compression of the spinal cord, correction of deformation, restoration of the supporting function of the vertebral column, and radical removal of the tumor. The use of additional internal fixation with metal implants significantly improves the treatment results in most cases and shortens the rehabilitation of patients due to primary stabilization of the spine in the early postoperative period. Using transpedicular devices ensures stable fixation and stability of the spine segments, even in case of destruction of the three columns (that is, in case of the maximum degree of spine instability).

Research objective: Determining the best options of posterior spinal fusion in palliative and radical surgical treatment of spinal tumors.

Materials and methods

Experimental trials were carried out on specimens of the pig spine to study the possibility of spine stabilization by means of transpedicular fixation in resection of one / two / three vertebrae. The specimens of segments of the thoracic spine from Th3 to Th12 vertebrae were used. Three groups of

models were studied: with 1 resected Th6 vertebra; with 2 resected Th5-Th6 vertebrae; and with 3 resected Th5-Th7 vertebrae.

Four methods of transpedicular fixation were used in the three groups of models: fixation system attached to one vertebra above and below the resected one; fixation system attached to two vertebrae above and below the resected one; fixation system attached to three vertebrae above and below the resected one; and fixation system attached to the first and the third vertebrae above and below the resection area. Experimental studies were carried out in the laboratory of biomechanics of State Institution "Professor M.I. Sitenko Scientific Research Institute of spine and joint diseases" under National Academy of Medical Sciences of Ukraine, Kharkov, Ukraine. The trials were carried out on a test bench for biomechanical research.

Research findings

Following the experiment results, it was found that transpedicular fixation as per the schemes 111x111, 101x101, and 011x110 in resection of one thoracic vertebra had virtually the same efficiency in terms of the magnitude of the displacement of a spinal motion segment in the resection area, which was evidenced by the absence of statistically significant differences at the minimum and the maximum loads. When resecting two thoracic vertebrae, a transpedicular fixation system applied as per the 111x111 scheme showed the best stabilizing features. The transpedicular 101xx101 and 011xx110 fixation schemes showed virtually the same test results, but they were worse than the 111xx111 scheme, with the result difference being statistically significant. The worst results, in terms of the magnitude of the displacement of the spinal motion segment in the resection area, were obtained by using the 001xxx scheme. Stabilization at resection of three thoracic vertebrae and the most stable fixation were shown by the models where the transpedicular fixation device was applied as per the 111xxx111 scheme. The 001xxx100 fixation scheme turned to be very unstable and dropped out of the experiment already at a load of 300 N.

Conclusions

Experimental studies of transpedicular fixation in radical surgical treatment of spinal tumors, which includes resection of one to three vertebrae, showed that the fixation device met the fixation requirements when the fixation devices are fixed to at least two upper and two lower vertebrae (placing fixation devices in the next but one vertebra position is possible). When three vertebrae are resected, the fixation system attached to each of the three upper and three lower vertebrae (without skipping vertebrae) is the most stable. The fixation system attached to one vertebra only was unsuitable in almost all types of resection.

EXPERIENCE WITH THE USE OF BIOMECHANICAL STIMULATION (BMS) IN REHABILITATION OF PATIENTS WITH POSTIMMOBILIZATION CONTRACTURES

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Relevance

When treating injured patients, immobilization is often used as one of therapy methods. However, prolonged immobilization often leads to contractures of varying degrees of severity; with the incidence of this complication being 50%. Even if a high quality standard rehabilitation program is carried out (mechanotherapy, exercise therapy, electrophoresis with Lydazum and Fermencol, etc.), only 35% of patients are able to achieve the full recovery of their range of motion. Post-mobilization contractures occur very often on the elbow and knee joints; and these joints are the most difficult to restore. Introduction to rehabilitation programs of biomechanical stimulation significantly improved the results of treatment.

Research objective: Determining the efficiency of the method of biomechanical stimulation in the treatment of post-immobilization contractures.

Materials and methods

226 patients with post-immobilization contractures of the upper limbs were treated in our clinic within the follow up period. The rehabilitation course included mechanotherapy, exercise therapy, electrophoresis with Lydazum and Fermencol (Group 1) in 54 patients; biomechanical muscle stimulation (BMS) was added to the baseline therapy in 172 patients. The BMS course consisted of 10 sessions of 10,000 pulses 2 times a week. The treatment efficiency was assessed by the severity of pain evaluated as per the visual analog scale (VAS), and changes in the range of passive and active motions.

Research findings and discussion

The following are the results of the treatment administered.

After 1 month of treatment:

- The range of active motions increased by 23% in the patients of Group 1, while it increased by 48% in Group 2.
- The range of passive motions increased by 41% in the patients of Group 1, while it increased by 75% in Group 2.
- The severity of pain decreased from 5.1 to 3.7 scores as per VAS in patients of Group 1, while it decreased from 5.7 to 1.8 scores in Group 2.

Conclusions

The inclusion of biomechanical muscle stimulation (BMS) into the rehabilitation program allowed us to achieve a more pronounced and rapid clinical effect, and to reduce the duration of a patient's incapacity for work.

REHABILITATION OF PATIENTS WITH PERTROCHANTERIC FEMORAL FRACTURES AFTER BLOCKED INTRAMEDULLARY OSTEOSYNTHESIS

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Introduction

Pertrochanteric fractures of the proximal femur traditionally take the lead among the causes of a prolonged temporary incapacity for work and primary disability in patients after injuries and diseases

of the musculoskeletal system. To treat patients with these fractures, various methods of stable-functional osteosynthesis are widely used in developed countries of the world; and blocked intramedullary osteosynthesis (BIOS) is the preferred option, which includes the possibility of early active rehabilitation. Development of rehabilitation programs for patients after surgical interventions including osteosynthesis is one of the most important vectors of modern reconstructive treatment of orthopedic and traumatologic patients.

Research objective: Development of rehabilitation measures in the integrated treatment of patients with femoral fractures following blocked intramedullary osteosynthesis.

Materials and methods

Treatment of 65 patients with isolated femoral fractures was analyzed. The patients were operated in Institute Clinic and in Poltava Regional Hospital. To treat patients, blocked intramedullary osteosynthesis (BIOS) was used in a period of 4 to 42 days. The treatment results were studied in a period of 6 months to 3 years after the surgery. The choice of the optimal term for a surgical intervention depended on the following factors: a patient's performance status; the method of fracture fixation by using BIOS; the type of fracture as per AO classification of fractures; in accordance with the biomechanical studies carried out by the authors, and the patent of Ukraine for the utility model. In case of A1 type fracture, which is vertically unstable but stable in the horizontal plane, the distal locking of the intramedullary rod was not performed; in case of A2 type fracture, which was unstable in vertical and horizontal planes, the distal locking of the intramedullary rod was performed with two screws; and in case of A3 type fracture, which is unstable in the horizontal plane and stable in the vertical plane, distal locking with 1 screw was performed.

Research findings

The proposed rehabilitation program was based on the fracture fixation method when using BIOS (i.e. using 2 and 1 blocked screws, and without using blocked screws for distal locking), and on the condition of reparative regeneration. The rehabilitation program was adapted for each of the above methods; and it had its own particularities of the loading level and terms. The programs included orthopedic behavior, massage, physiotherapy, and therapeutic gymnastics, which observed graduated exercise and made it possible for 100% of patients to have efficient rehabilitation with the consolidation of the fracture, and to the return the function of the operated limb.

Conclusion

The introduction of rehabilitation programs proposed by the authors in patients with interacetabular fractures after performing blocked intramedullary osteosynthesis will allow andinistration of the comprehensive differential treatment and improve the efficiency of the medical care provided to thysy severely ill patients.

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RESEARCH OF ACTIVITY OF M. ERECTOR SPINAE IN PERSONS WITH ASYMMETRICAL POSITION OF THE PELVIS AND SACRUM

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The sacroiliac joints (SIJs) are the key link that transfers the weight of the upper half of the body to the pelvis and lower limbs. Adequate SIJ function also ensures the integrity of the pelvic ring and the axial stability of the body. The axial stability of the body is ensured by the rigidity of both passive (bones and ligaments) and dynamic (coordinated muscle contraction) structures. Axial stabilization is important to protect the lumbar spine and to transmit a wide range of forces that affect the spine and axial muscles when moving the limbs.

Research objective: Studying the change in electromyographic activity of m. erector spinae while maintaining a vertical axial position when in two-support and on single-support standing with and without a load, at various parameters of the frontal vertebral pelvic balance.

Materials and methods

36 students of Faculty of Physical Education of G.S. Skovoroda Kharkov National Pedagogical University were assessed. A surface myogram was recorded in the site of muscle projection in all the subjects. The following indicators were analyzed: maximum amplitude, average amplitude, total amplitude, and average frequency of a signal when filtering frequencies below 20 Hz. The volunteers were divided into 5 groups: "0" - without bending; "S<3", "S>3", "D<3", "D>3" - the bending side is more / less than 3°.

Research findings and discussion

Analysis of the myographic data of activity of m. erector spinae, which are taken from contralateral muscles, while standing still on two legs, revealed statistically significant differences only for the average amplitude in group "D>3". The test carried out when standing on one foot made it possible to get an idea of the work of m. erector spinae at unilateral stress. In this case, it may be expected that the level of the electromyographic signal will be approximately the same under condition of anatomical symmetry when alternately raising the right and left leg. A statistically significant difference in the signals of the supporting and elevated limbs was observed in groups with an inclination of the sacrum and/or the pelvis S>3 ° in terms of all measured parameters. The test performed when standing on the right foot showed an increase in all indicators of the limb, except for groups D>3°. In these cases, a change is observed: the signal from the supporting limb is smaller than the signal from the raised limb, although no statistically significant difference was found. When standing on the left foot, significant differences in all parameters were established only for the group with the angle of inclination of the pelvis and sacrum D<3 °. When analyzing the data of the reinforced test (when standing on one foot with a load), a statistically significant difference in the parameters of the electromyogram was found at the side of the raised leg. At the same time, an increase in parameters of the non-supporting left limb was revealed, although the difference in values is not significant. When standing on the right foot for groups S<3, S>3 and D<3, differences in all the parameters of the electromyogram are observed; while an overturn in values is observed in group D>3. When standing on the left foot with a load, a reliable asymmetry of the levels of electromyographic indicators was noted in three groups S<3, S>3, and D<3, with a predominance of their amplitude on the supporting side. When analyzing this test, a significant difference in the level of maximum and total amplitudes and average frequency for persons with zero pelvic inclination was noted for the first time.

In the study, we found interesting facts: the activity of the left side of m. erector spinae has, on average, greater activity than the activity of the right side of the muscle. Analysis of the results obtained makes it possible to explain this particularity by the following fact. The volunteers were students of the Institute of Physical Culture, i.e. people whose life style includes daily intensive workouts. In most sports, the right limb is a swimming limb (i.e. more mobile), while the left limb is the supporting one (it assumes the bulk of body weight). As a result, the particularities of the functionality of the right and left side of the muscular sling of the body are also formed.

Conclusions

1. The frontal slope of the skeleton "sacrum-pelvis" components leads to asymmetric activity of the contralateral portions of m. erector spinae, which increases as angle of inclination increases.
2. When standing on one foot in persons with no lateral inclination of the sacrum and the pelvis, a higher muscle activity is observed on the side of the supporting limb, however, as the pelvic tilt increases towards the supporting limb, there is significant muscle activation in the raised limb.

In an enhanced option of this test (standing on one foot with a load), a greater difference between the muscle activity on the side of the supporting limb and on the side of the raised limb is revealed.

PATHOGENESIS OF ROTATOR CUFF INJURIES

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Made from the perspective of general pathology, the analysis of the mechanism of development of pathological changes in the tissues of the rotator cuff made it possible to propose the concept of the mechanism of the development of pathological changes in the rotator cuff. This concept is based on the generally accepted provision that the action of any damaging factor, whether an injury, recurrent microtrauma, or immune and non-immune complexes formed against the background of immune inflammation in the body, all this causes the development of reactive inflammation of the structures of the pectoral girdle, including the rotator cuff.

Morphological particularities of the shoulder joint tissues contribute to the development of a reactive inflammation in the structures of the pectoral girdle. In particular, a significant content of cells, including facultative macrophages actively involved in the implementation of the inflammatory process. Activation of these cells is accompanied by the release of biologically active substances, i.e. inflammatory mediators, such as prostaglandin E₂, which is one of the most active inflammatory mediators that affects the vascular endothelium, cartilage, muscle and tendon tissue; tumor necrosis factor (TNF) and interleukin-1 (IL-1), which stimulate the production of cytokines, the growth of fibroblasts, and the release of metalloproteinases by fibroblasts and synoviocytes. All this leads to pathological changes, which are underlain by inflammatory enthezopatiya, i.e. inflammation of the

attachment of joint tendons, ligaments, and capsules to the bones, which leads to periosteal growths, and to their ossification later on. Biologically active substances released in the process of the development of inflammation determine both the severity of pathological changes in the tissues and the nature of the inflammation course. Permanent activation of the mechanisms of the development of the inflammatory process contributes to the chronization of the inflammatory process, i.e. dysregulation leading to the development of dystrophic changes in the tissues of the pectoral girdle, in particular in the rotator cuff; and its rupture occurs against the background of the dystrophic changes.

Based on these preconditions, we developed a classification of **the pathological states of the rotator cuff**, which can be used as an algorithm for the treatment strategy of the studied patient category.

The basis of the classification developed was the concept of the mechanism of the development of pathological changes in the rotator cuff; according to the concept, the leading factor of their pathogenesis, regardless of the cause, is inflammation; the mechanisms of the inflammation determine the nature of the morphological changes in the tissues of the rotational cuff. Therefore, it is the morphological changes in the tissues of the rotator cuff, which are considered in the context of the mechanisms of development of the pathological process, and their connection with its clinical manifestations were the basis of the proposed classification. We propose to allocate five morphological stages of the pathological state of the rotator cuff.

First stage: Acute tendomyositis. The pathophysiological basis of this disease stage is acute reactive inflammation as a reaction to damage to the tissues of the rotator cuff. When observing the correct motion regime and adequate treatment, the recovery process proceeds according to the type of normal regeneration and ends with restitution.

Second stage: Chronic tendomyositis. Chronization of the inflammatory reaction translates the recovery process into the disregeneration stage, when restitution is practically impossible.

Third stage: Tendomyofibrosis. As chronic inflammatory process progresses, sclerosis of the tendon tissue of the rotator cuff occurs; the tendon stretching loses its elasticity and smoothness; the normal work of the tendon to redistribute loads is disrupted; the normal tendon slipping under the coracoacromial arch is disrupted. As a result of the progressive accumulation of regenerated tissues (a sign of chronic inflammation), the reserve space between the acromion and the proximal humerus decreases, conditions for the permanent injury of the rotator cuff appear when doing normal motions of the upper limb.

Fourth stage: Tendomyodystrophy. The stage is morphologically characterized by marked dystrophic changes in rotator cuff tissues, which lead to solution of its continuity.

Fifth stage: Tendomyomalacia. This is the so-called “rotator cuff arthropathy” or, as we suggest to call this condition, arthropathy of the shoulder joint against the background of dystrophic changes of the rotator cuff. Morphologically, this condition is characterized by almost complete destruction (melting) of the rotator cuff tissue, with dystrophic changes in the muscles and marked dystrophic phenomena in the shoulder joint and periarticular tissues.

All the pathological conditions of the rotator cuff presented are stages of a single pathological process whose main pathophysiological element is an acute reactive inflammation of the rotator cuff tissues. Each stage has its own morphological basis, clinical picture, and requires its own medical tactics.

CASE OF TIBIAL ADAMANTINOMA

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Introduction

Adamantinoma is a very rare malignant tumor of bones of epithelial origin, wherein the structures resembling the enamel body of the tooth primordium are formed. According to published data, adamantinoma incidence is within the range of 0.3 to 0.48% among malignant bone tumors. Most often the tumor develops between the age of 10 and 30 years in women and the age of 30 and 50 years in men. It is characterized by a slow, calm, and painless development. Its development may be within a period of 1 year to 5 and even 20 years or more. However, the tumor may develop with violent manifestations, local relapses, and metastases in the lymph nodes, other bones, and lungs in 15-22% of cases. Two forms of adamantinoma may be macroscopically distinguished: solid and polycystic.

Research objective: Searching bone adamantinoma treatment methods.

Materials and methods

A 35-year-old patient was followed up; he was admitted to our department with complaints of pain and the presence of a tumor of the upper and the middle thirds of the right tibia. The tumor appearance was attributed to the tibia fracture. At the examination: atrophy of the leg muscles, skin thinning, strengthened venous pattern, and local skin hyperthermia over the tumor at palpation.

X-Ray: a focal lesion of 17 cm located in the upper and middle third of the center of the tibia; the focal lesion breaks the cortical layer and enters soft tissues; inhomogeneous structure of the focal lesion: larger and smaller round foci are visible, with the foci separated by partitions; the periosteum is laminated in the form of a visor; periosteal spicular proliferations are observed.

An open bone biopsy was performed on the patient, with histological conclusion being: adamantinoma.

After examination, the patient underwent a segmental resection of the proximal tibia and knee joint replacement with an individual oncological implant. The postoperative period proceeded without complications, the stitches were removed in 14 days after the surgery; operative wound healed by first intention.

Results

The tumor recurrence was developed in a patient in 4 years after a limb-conservative surgery; and an amputation of the lower limb at the level of the middle third of the hip was performed on the patient. Six months later, metastases in the lungs were diagnosed in the patient. The patient received 3 courses of intravenous polychemotherapy: ifosfamid, carboplatin, and etoposide, with metastasesectomy in the lungs performed.

In 3 months, new metastatic foci appeared in the lungs, and despite the courses of polychemotherapy, the patient died in 4 months. Thus, despite the radical removal of the tumor, the final outcome of the treatment of this kind of tumor was unsatisfactory.

Conclusions

A limb-preserving surgical treatment of a patient with tibial adamantinoma failed to lead to a favorable outcome, suggesting the need for an integrated treatment of these patients.

AFFORDABILITY AND ROLE OF THE PRIMARY HIP JOINT REPLACEMENT WITH THE ETBS-ITO SYSTEM MADE BY MOTOR SICH JSC AT REGIONAL HOSPITAL

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Introduction

Primary total hip replacement is a reliable and efficient method of surgical treatment of the femoral neck fractures and severe degenerative diseases of the hip joint. A good rehabilitation effect of surgery and a prolonged functioning of the artificial joint provide the patient with the joy of motion.

Research objective: Substantiating the role and significance of the primary hip joint replacement with the ETBS-ITO system made by Motor Sich JSC and the material and technical basis at regional hospital.

Materials and methods

About 15 thousand people need joint hip replacement in Ukraine annually. Volochisk Mechanical Engineering Plant is a subsidiary company of Zaporozhye Motor Sich JSC, and it became a basis for the use of domestically produced implants to improve health of the plant workers and the whole population of the Volochisk Region. Mr. Vyacheslav A. Boguslayev, Hero of Ukraine and People's Deputy, identified the priority development of the joint replacement with the ETBS-ITO system made by Motor Sich JSC in our region. Lack of governmental programs, growing disability, poor material and technical base, and high cost of foreign competitor products are the factors that made us introduce the hip joint replacement in Regional Hospital.

The doctors are trained at the Shupik National Academy of Postgraduate Education, which is headed by Professor Ankin M.L., and at Traumatology Department of Motor Sich Clinic, which is headed by Chorniy V.M., PhD in medicine and associate professor of the department of Zaporozhye State Medical University. Medical staff: 2 doctors with a higher category (with experience more than 20 years); one doctor with the first category (with experience of 10 years); one doctor with the second category.

Buffer kits for cemented and cementless implants were provided by Motor Sich JSC free of charge; 2 separate chambers for 4 beds were redesigned.

The patients who received treatment were assessed clinically and radiologically (ultrasound examination of the veins of the lower limbs, ultrasound examination of the abdominal cavity, X-Ray of the lungs, consultation of the ENT, dentist, cardiologist, surgeon, anesthesiologist), and laboratory tests (activated partial thromboplastin time, etc.).

69 following operations were performed within a period from May 2015 to June 2017:

- Unipolar implants - 2 (in women aged 92 years and 87 years old with hip head fractures);

- Cemented implants – 43, cementless implants – 20;
- Operations for hip joint replacement in femoral neck fractures (including old fractures) - 16/8;
- Coxarthrosis - 45 (including bilateral - 29, unilateral - 16).

There were 40 women and 29 men.

The average age of the patient was 58 ± 4 .

4 urgent hip replacements (cemented) were performed.

The complications of cemented implants were as follows:

- Postoperative hip dislocation (due to non-compliance with the regime), which was eliminated by means a usual closed reposition.
- Recurrent hip dislocation (after an old hip neck fracture), which requires a repeated surgical intervention with more tight capsule sutures.

Conclusion

Implementation of the primary hip joint replacement in regional hospital became affordable provided the presence of the factors as follows: appropriate material and technical base, skilled personnel, support of local authorities, a stable pricing policy of Motor Sich JSC, and a sufficient number of patients. The implants of the domestic brand made by Motor Sich JSC correspond to the Price-Quality Strategy.

DEVELOPMENT AND OPTIMIZATION OF THE CHEMICAL COMPOSITION OF A NEW DEFORMABLE MAGNESIUM ALLOY FOR IMPLANTS IN OSTEOSYNTHESIS

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Magnesium alloys are promising biodegradable materials due to their biological inertness and non-toxicity. As a result of previous studies, a casting magnesium alloy of the Mg-Zr-Nd system was developed, which possesses sufficient mechanical properties and the necessary rate of biodegradability. The implants made the alloy of underwent clinical tests.

However, despite all the advantages of casting alloys, the level of their mechanical properties is insufficient for the production of sophisticated implants with a small cross section (wires, rods, plates), which are made by plastic deformation methods. The solution to this problem is the development of a new wrought magnesium alloy with improved mechanical properties.

To be efficiently deformed, the magnesium alloy should have the highest possible ductility while maintaining a sufficiently high level of mechanical strength. According to the Mg-Nd and Mg-Zr equilibrium phase diagrams, the solubility limits of neodymium and zirconium in the solid state are 3.36% and 1.5%, respectively. These values exceed the maximum content of the corresponding alloying elements according to GOST state standard, which makes it possible to improve the whole diversity of mechanical properties of the alloy by increasing the content of neodymium and zirconium. Analysis of the equilibrium phase diagrams showed that an increase in the neodymium content in the alloy may lead to additional alloying of the solid solution, as well as to the formation of a larger amount of hardening phase $(\text{MgZn})_{12}\text{Nd}$, which will increase the tensile strength (σ_B). An increase in

the zirconium content in the alloy may lead to an increase in the number of crystallization centers, which contributes to an increase in the relative elongation (δ). Thus, the additional alloying of magnesium alloy with neodymium and zirconium is promising for increasing the the whole diversity of mechanical properties.

We studied the effect of the content of the main alloying elements (Zr, Nd, Zn) of the magnesium alloy on its mechanical properties within the following limits: Zr - 0.4 ... 1.5%; Nd - 2.2 ... 3.36%; and Zn - 0.1 ... 0.7%. To determine the effect of the number of alloying elements (Zr, Nd, Zn) on the temporary tensile strength (σ_B) and relative elongation (δ), the experiment design matrix was used as per Plan 2³.

The magnesium alloy of the Mg-Zr-Nd system was smelted in an induction crucible furnace of the IPM-500 type as per serial technology. The melt was refined with БИ-2 flux in a distributing furnace, from which metal was batchwisely taken with a ladle, and increasing additives of alloys containing Zr, Nd, and Zn were introduced. Standard samples for mechanical tests were poured into a sandy-clay mould. The samples were heat treated in furnaces such as Bellevue and PAP-4M according to the mode: quenching at a temperature of $415 \pm 5^\circ \text{C}$, aging for 15 hours; air cooling and aging at a temperature of $200 \pm 5^\circ \text{C}$; aging for 8 hours; and air cooling. Temporary tensile strength (σ_B) and relative elongation (δ) of samples with a working diameter of 12 mm were determined on a P5 tensile testing machine at room temperature. The number of experiments for each level of the planning matrix was eight, and the number of series of experiments at the zero level was three.

As a result of the research, regression equations were obtained to describe the effects of neodymium (1) and zirconium (2) on tensile strength (σ_B) and relative elongation (δ), respectively:

$$\sigma_B = 251.63 + 15.875x_2 - 8.875x_1x_2 \pm 0.14 \text{ (MPa)} \quad (1)$$

$$\delta = 4.0375 + 0.6125x_1 - 0.788x_1x_2 \pm 0.13 \text{ (\%)} \quad (2)$$

Analysis of the mathematical models obtained shows that an increase in the neodymium content significantly increases the strength level of the alloy, while zirconium increases plasticity. A combination of neodymium and zirconium has a negative effect on both characteristics.

Considering that the alloy under study should have the maximum level of mechanical properties, its chemical composition was optimized. As a result, the highest mechanical properties ($\sigma_B = 255 \text{ MPa}$, $\delta = 4.0\%$) are ensured by the following content of chemical elements: Zr = 1.1 - 1.2%, Nd = 2.9 - 3.0%. The use of the wrought magnesium alloy developed will make it possible to manufacture sophisticated implants with a small cross section.

USING EXTRAFOCAL OSTEOSYNTHESIS FOR TREATMENT OF TRAFFIC ACCIDENT MUSCULOSKELETAL POLYTRAUMA

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One of the main causes of the unresolved medical and social problems caused by traffic accident injuries is lack of clear understanding of the nature and severity of traffic accident polytrauma. Despite

a permanent improvement of the methods of polytrauma treatment, the mortality, as well as the incidence of complications and disability have little downward trend. Road traffic injuries represent a sophisticated medical and social issue whose consequences are often the loss of working capacity and the transition to disability of the working age population, which, besides purely medical aspects, negatively affects the social and economic condition of a state or a region, causing significant economic losses. More than 1.2 million people per year die in road traffic accidents, and more than 20-50 million people are injured every year [1]. According to various authors, complications with polytrauma develop in 28-100% of cases.

The analysis of academic literature on the subject showed that the choice of the best treatment methods for persons injured in traffic accidents was relevant and caused debates. Some academic publications on the subject are devoted to traditional treatment methods for traffic polytrauma, while other sources offer surgical intervention. There is no consensus on the choice of methods for surgical treatment of polytrauma. A number of scientists recommend osteosynthesis to be used in polytrauma early or immediately once the injured person has been brought out of shock; other scientists find early intervention on the limb bones unacceptable. Discussions also appeared with regard to the use of osteosynthesis, as some scientists propose the use of one-time osteosynthesis of several segments, while other scientists insist on the use of traditional and non-invasive osteosynthesis. Today, the treatment of persons with polytrauma, which were injured in road traffic accidents, are actively introduced into the clinical practice by using devices for extrafocal osteosynthesis with external fixation: the SCID I-II (KhNIITO) rod devices and Ilizarov apparatus for extracortical osteosynthesis.

Research objective: Analyzing the experience in treatment of persons with traffic accident polytrauma of the musculoskeletal system by using the method of extrafocal osteosynthesis.

Materials and methods

The study material was taken from medical histories of 126 persons with polytrauma of the musculoskeletal system, which were injured in traffic accidents; the patients were followed up in Sumy Regional Orthopedic and Traumatological Center for a period from 2014 to 2016.

Research findings and discussion

A wide range of surgical treatment methods was used to treat traffic accident polytrauma patients. The therapeutic tactics was chosen individually in each particular case, taking into account three main factors: a patient's performance status, the localization and nature of the fracture, as well as the type of combination of the injuries.

To treat isolated fractures, a single method was usually chosen, while an integrated plan was used to treat multiple fractures, which included resuscitation measures and several methods of conservative or operative reduction and fixation of fractures, depending on their number and nature.

To treat traffic accident polytrauma of musculoskeletal system, conservative treatment methods were used in 34 people, which is 26.9% of the total number of the persons with traffic accident polytrauma. Several conservative methods were used simultaneously in 19 injured persons with upper and lower extremity fractures. The upper limb fractures were more often reduced by a single-step closed method followed by plaster casting or plaster splinting, while in case of lower limb fractures, skeletal traction was carried out or the rod apparatus of the extrafocal fixation was superimposed.

Modern possibilities of stable osteosynthesis in combination with the achievements of anesthesiology and resuscitation, as well as antibiotic therapy, make it possible to improve therapeutic tactics for multiple and combined injuries in the persons with traffic accident polytrauma of musculoskeletal system. In serious lesions of musculoskeletal system, which do not require surgical treatment, it is practical perform osteosynthesis once the injured person has been brought out of a shock condition. Submersing osteosynthesis should be used for the treatment of injured persons with closed injuries, which are in a relatively satisfactory condition.

Extrafocal osteosynthesis was performed in 57% of case with external fixation devices: SKID I-II (KhNIITO) rod devices and Ilizarov apparatus. Extracortical osteosynthesis was used in 21.6% of the injured persons.

Analysis of the results of the study of 126 injured persons showed that treatment with extrafocal osteosynthesis with rod apparatus had good results when it was used for 3 weeks. Satisfactory results were observed only in 8 injured persons (in 6.3% of cases).

When external fixation devices on the basis of rods are used on the upper limb, we did not observe the development of contractures in the shoulder and elbow joints. The suppuration of soft tissues in the rod area was observed only in 6 injured persons. Such complications, in our opinion, are related to the conduction of the rods through muscles imbued with blood. The complications were relieved by limiting motor activity for a short time: immobilization on a wedge-shaped pillow and local anti-inflammatory treatment. When mounting rod-type external fixation devices in the injured persons with polytrauma of musculoskeletal system, no evidence of lesion of the major vessels and nerves were observed when installing the rods, which suggests that the technique is safe in this respect, taking into account the topographic and anatomical particularities of the segment.

Application of external fixing devices on the basis of rods is indicated in cases of open injury of the segment with a large area of damaged soft tissues, which requires dynamic monitoring of the wound process; at comminuted metadiaphyseal fractures of the segment; in combined and multiple lesions of long tubular bones. The rod external locks make it possible to successfully treat complicated fractures of traffic accident polytrauma, especially with open limb fractures and with damaged soft tissues.

Conclusions

Following the study results, it was found that the use extrafocal fixation with rods is highly efficient when choosing an operative treatment method for persons with polytrauma of musculoskeletal system, which were injured in traffic accidents. The extrafocal fixation with rods is indicated in the period of 1 day to 3 weeks after injury. Extrafocal osteosynthesis with external fixing devices facilitates the care of the operated patients; makes it possible to perfectly reduce the bone chips, which is especially important for intra-articular fractures and makes it possible to restore mobility of the musculoskeletal system quickly and with minimal trauma, and provides rapid rehabilitation of the damaged limb.

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