

ILIZAROV TECHNIQUE



bari-ilizarov orthopaedic centre

72 SAT MASJID ROAD, NIZAM'S SHANKAR PLAZA, DHANMONDI, DHAKA-1209, BANGLADESH
email: barilizarov@gmail.com, Phone: 880 2-9120309, 880 2-9116152, Web: www.bariilizarov.com



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72 SAT MASJID ROAD, NIZAM'S SHANKAR PLAZA, DHANMONDI, DHAKA-1209, Bangladesh



PROPOSED BARI-IIZAROV ORTHOPAEDIC CENTRE

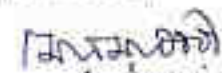
General Information about the Bari-Iizarov Orthopaedic Centre

The Bari-Iizarov Orthopaedic Centre is the first in Bangladesh to develop and clinically apply techniques of limb lengthening and treatment of bone defects. Excellent results have been achieved during the last few years in the treatment of chronic osteomyelitis, congenital and acquired foot and hand deformities. Iizarov mini-fixators are applied in the shoulder, knee, elbow and hand joints into its practice. Joint replacement surgery in combination with transosseous osteosynthesis is a unique technique developed by the Bari-Iizarov Centre. It prolongs implant survival period in people who lead an active lifestyle. In treatment of patients with degenerative-dystrophic diseases of large joints, the Centre applies different variants of joint replacement in combination with the Iizarov apparatus.

Basic scientific activities of the Centre are as follows: developing and grounding effective methods of treatment and rehabilitation of patients with comminuted, intra-articular, gunshot, open, multiple and combined fractures of extremities and pelvis; new lengthening technologies, filling-in limb defects and reconstructive treatment of patients with pathologies of foot and hand and spinal surgery.

Surgeons of the hospital perform more than 1200 trauma and orthopaedic operations each year, using high-tech methods of treatment.

There are 32 employees at the Centre. The staff of the Centre includes 2 Professors, 6 Orthopaedic Surgeons. Prof. Ph.D. M M Bari is currently visiting and Honored Professor of Russian Iizarov Scientific Centre, Kurgan (the largest Orthopaedic Centre in the world.)


15.06.14





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Preface

Bari-Illizarov Orthopaedic Centre was established in 1997 by Dr. M.M. Bari, a pioneer in the field of Ilizarov surgery in the country. M.M. Bari began its journey with 7 bedded Ilizarov centre in Dhaka. Today it is a 22 bedded dedicated Ilizarov Orthopaedic Hospital. We render highly specialized services in difficult orthopaedics which includes –

1. Limb lengthening and reconstruction
2. All kinds of deformity correction
3. Complex trauma (Fractures and injuries to muscles, bones and joints)
4. Ilizarov spine surgery
5. Adults orthopaedics
6. Paediatric orthopaedics and so on.

Thus it is the only one super specialty Ilizarov centre in Bangladesh with almost all the orthopaedic problems can be solved under one roof.

Every month more than 100 Ilizarov surgeries are performed in this centre.

At Bari-Illizarov Orthopaedic Centre, all efforts are made and no stone is left unturned to make the patient happy. A commitment to ethical medical practice plays a key role in ensuring the patient who receives the best available treatment at an affordable cost.



Patients treated in different hospitals by Ilizarov Technique

Pathologies and patients treated with the Ilizarov technique in 1989 to 2013 (according to NITOR, Narayanganj, 200 bedded Hospital, Mymensingh Medical College Hospital and Bari-Ilizarov archives files)

	Different disease	No. of patients	% patients treated	Age range (years)
Bone injuries and their Sequelae:	Severe open and closed fractures of any location, including gunshot fractures; pelvis injuries; Intraarticular fractures; spine injuries, delayed union, non union & malunion.	12,100	100%	2-90
Bone disease	Achondroplasia, low stature (lengthening of all segments of the upper and lower extremities); Congenital and acquired foot deformities (clubfoot, equinovarus or equinus deformity, calcaneal foot, etc), Deforming arthrosis and ankylosis of large joints, Shin and foot stumps (lengthening and shaping foot-like support), bone defects, Congenital and acquired pseudoarthrosis of long bones, varus and valgus long bone deformities, congenital and pathological hip dislocation, Osteochondropathy of the hip joint (Perthes' disease), Knee osteoarthrosis, Genu Varum and Genu Valgum; Uricameral bone cysts, bone fibrous dysplasia, benign bone tumours; Malformation in the limbs, benign bone tumours. Congenital finger shortening and stumps, maldevelopment in the hand, syndactyly; CTEV (relapsed; neglected rigid), Injuries and diseases of the spine and the spinal cord (acute and neglected, chronic injuries to the vertebral column with cord and cauda equina roots compression, kyphosis, scoliosis, spondylolisthesis, disc herniation), Poliomyelitis consequences (Long bone thickening); osteomyelitis; CP (Cerebral Palsy) consequences; PVD (peripheral vascular disease) TAO (Thrombo-angitis obliterans, buerger's disease), fibular hemimelia, tibial hemimelia; windswept deformity.	9,600	100%	1-70
Height increase	Leg lengthening	12,100	100%	2-90



Cubitus Varus

('GUN STOCK' DEFORMITY)



This causes little functional impairment as the deformity is most obvious when the elbow is extended and the arms are elevated. The most common cause is malunion of a supracondylar fracture. The deformity can be corrected by opening wedge osteotomy (gradual controlled coordinated stretching by Ilizarov technique).



Fracture dislocation of the shoulder

Trauma to the shoulder is common. Injuries range from a separated shoulder resulting from a fall onto the shoulder to a high-speed car accident that fractures the shoulder blade (scapula) or collar bone (clavicle). One thing is certain: everyone injures his or her shoulder at some point in life.

The shoulder is made up of three bones:

- Scapula (shoulder blade)
- Clavicle (collar bone)
- Humerus (arm bone)

These bones are joined together by soft tissues (ligaments, tendons, muscles, and joint capsule) to form a platform for the arm to work.

The shoulder is made up of three joints:

- Glenohumeral joint
- Acromioclavicular joint
- Sternoclavicular joint



Nonunion Right Ulna



Nonunion is permanent failure of healing following a broken bone.

Nonunion is a serious complication of a fracture and may occur when the fracture moves too much, has a poor blood supply or gets infected. Patients who smoke have a higher incidence of nonunion. The normal process of bone healing is interrupted or stalled. In some cases a pseudo-joint (pseudarthrosis) develops between the two fragments with cartilage formation and a joint cavity. More commonly the tissue between the ununited fragments is scar tissue.

Since the process of bone healing is quite variable, a nonunion may go on to heal without intervention in a very few cases. In general, if a nonunion is still evident at 6 months post injury it will remain unhealed without specific treatment, usually orthopedic surgery. A non-union which does go on to heal is called a delayed union.



Elbow flexion contracture



Stiff elbow is not an uncommon condition. It disturbs activities of daily living, such as reaching hand to face, toilet etc. It becomes a disability if both elbows are affected. Normal range of elbow motion is 0° to 145°. Elbow stiffness is not an uncommon problem that can interfere with a patient's ability to perform activities of daily living. The elbow's primary function is to position and stabilize the hand in space. Patients do not tolerate elbow stiffness well because adjacent joints cannot provide adequate compensatory motion. Functional range according to Morrey is 30° to 130°. However, recently shown 70° to 120° is a good functional range. Functional pronation and supination are 50° each. The aim of treatment of a stiff elbow is to achieve the functional range.

Causes of stiff elbow are varied. Post-traumatic or post-surgical stiff elbow is the commonest.

Cubitus Valgus



This deformity is due to injury causing an immediate deformity by malunion of a fracture or a gradual developing deformity due to damage and premature arrest of the lower humeral growth plate. It is the classical (but not the commonest) cause of tardy ulnar nerve palsy, because the ulnar nerve now has to take a longer course behind the medial epicondyle. The normal carrying angle of the elbow is 5-15 degrees of valgus, anything more than this is reported as a valgus deformity, which is usually quite obvious when the patient stands with arms to the sides and palms facing forwards. The deformity itself needs treatment, but for delayed ulnar palsy it can be corrected by (gradual controlled coordinated stretching) ilizarov technique after the opening wedge osteotomy.



Tumor GCT

GCT of Right head of humerus

Giant cell tumor of the bone is a relatively uncommon tumor that is characterized by the presence of multinucleated giant cells. This type of tumor is usually regarded as benign. In most patients, giant cell tumors have an indolent course, but they can recur locally in as many as 50% of cases. Metastasis to the lungs may occur.



Most giant cell tumors occur in the long bones (see the images below), and almost all are located at the articular end of the bone. Metaphyseal involvement may occur in skeletally immature patients. Common sites include the proximal tibia, distal femur, distal radius, and proximal humerus, although giant cell tumors have also been reported to occur in the pubic bone, calcaneus, and feet.



Arthrogryposis

Arthrogryposis multiplex congenita (AMC), or simply arthrogryposis, describes congenital joint contractures in two or more areas of the body. It derives its name from Greek, literally meaning "curving of joints" (arthron, 'joint'; gr?posis, late Latin form of late Greek gr?posis, "hooking").[1] Children born with one or more joint contractures have abnormal fibrosis of the muscle tissue causing muscle shortening, and therefore are unable to do passive extension and flexion in the affected joint or joints.[2] AMC has been divided into three groups: amyoplasia, distal arthrogryposis, and syndromic. Amyoplasia is characterized by severe joint contractures and muscle weakness.[3] Distal arthrogryposis mainly involves the hands and feet. Types of arthrogryposis with a primary neurological or muscle disease belong to the syndromic group.[3]





Legg-Calvé-Perthes Disease



9-years-old child demonstrating limitation of internal rotation of right hip. Hip rotation best assessed in prone position because any restriction can be detected and measured easily



Same child demonstrating Thomas test for hip flexion contracture. Opposite hip flexed only until lumbar spine is flat against examining table. Lack of full extension in involved hip recorded. Child demonstrates 15° hip flexion contracture typically found in Legg-Calvé-Perthes disease.



Test for limitation of abduction. With child supine on table and relaxed, lower limbs gently and passively abducted to determine degree of motion of each limb.



9-years-old child demonstrating limitation of internal rotation of right hip. Hip rotation best assessed in prone position because any restriction can be detected and measured easily



"Roll" test for muscle spasm. Patient relaxed, lying supine on table. Examiner places hands on right limb, gently rolls hip into internal and external rotation, noting resistance



Determination of proximal thigh atrophy. Circumference of each upper thigh measured and difference noted. Measurements should be made at most proximal level of thigh



Legg-Calvé-Perthes Disease



Legg-Calvé-Perthes disease, also known as Perthes' or Legg-Perthes disease, osteochondritis deformans juvenilis, and coxa plana is a disorder affecting the capital femoral epiphysis. Although it is one of the most common hip disorders of childhood, it has been one of the most confusing and poorly understood diseases in pediatric orthopedics.



Knee Dislocation



Knee dislocation is a relatively rare injury but an important one to recognize because coexistent vascular injury, if missed, often leads to limb loss. In addition, knee dislocation often presents in the context of multisystem trauma or spontaneous relocation, which makes detection more difficult.



Neurofibromatosis



Neurofibromatosis (NF) refers to a number of inherited conditions that are clinically and genetically distinct and carry a high risk of tumor formation, particularly in the brain.[1] Neurofibromatosis is an autosomal dominant disorder, which means only one copy of the affected gene is needed for the disorder to develop. Therefore, if only one parent has neurofibromatosis, his or her children have a 50% chance of developing the condition as well (it is rarely the case that one person has the mutated gene twice, which would imply a 100% chance of their children developing NF). The severity in affected individuals can vary; this may be due to variable expressivity. Approximately half of cases are due to de novo mutations and no other affected family members are seen. It affects males and females equally. In addition, some individuals may have mosaic NF, in which some but not all cells of the body carry the mutation.



Wind swept deformity

Wind Swept Deformity – 17years old boy

Windswept hip deformity describes an abduction and external rotation position of one hip with the opposite hip in adduction and internal rotation.

Windswept hip deformity may occur in association with hip dislocation and scoliosis. We analysed the prevalence of this deformity in a total population of children with cerebral palsy, and the impact of hip prevention and early treatment of contractures on the prevalence and severity of windswept hip deformity. The frequency of windswept hip deformity was 12% in the control group and 7% in the study group, comprising children in the hip prevention programme.

The children with this deformity in the study group had a lower frequency of scoliosis and none had hip dislocation.

It thus seems that the hip prevention programme results in a decrease in the number of children with windswept hip deformity, and a decrease in the severity of the deformity.



Nonunion Humerus

Nonunion right humerus



Fractures of the humerus constitute approximately 5% to 8% of all fractures. Treatment varies according to location of the fracture. Although most humerus fractures heal uneventfully, nonunion can occur. Nonunions often result in shoulder and/or elbow stiffness, prolonged and debilitating pain, which can lead to narcotic dependence. Risk factors for nonunion include patient conditions such as osteoporosis, obesity, alcoholism and smoking. Comminuted or segmental fractures, soft tissue interposition at the fracture site and infection may also result in nonunion. Finally, iatrogenic factors include overdistraction, inadequate stabilization or immobilization of the fracture.

Reconstruction of the Limb versus Amputation



Reconstruction of the limb due to badly injured trauma for successful outcome depends on several factors:

Some of these are -

1. Type of injury.
2. Time of injury.
3. Poor blood supply.
4. Age of the Patient.
5. Condition of the patient at the time of injury may be because of shock.

6. Multiple organ failure.

7. Other comorbid conditions and facilities for proper management of any trauma patient.

We live in a time of great change. Our approach to trauma patient has changed, as well. We now try to save limbs and restore normal function in severely injured limbs that would have been amputated 40 years ago. We have made remarkable progress in the management of fractures and dislocations due to considerable new

knowledge in fracture fixation. New options and procedure for managing simple and complex musculoskeletal injuries, advances in sepsis prevention and treatment, improved understanding of immunologic and metabolic response to trauma and better training for surgeons and paramedical staffs. For fracture and dislocation management there are various satisfactory treatment options. You can choose which option is appropriate for the particular musculoskeletal injury you are treating. The wise surgeon should discriminate among management options based on their merits.



Pilon Fracture



Pilon fractures affect the bottom of the shinbone (tibia) at the ankle joint. In most cases, both bones in the lower leg, the tibia and fibula, are broken near the ankle.

Pilon is a French word for pestle, an instrument used for crushing or pounding. In many pilon fractures, the bones of the ankle joint are crushed due to the high-energy impact

causing the injury. Pilon fractures may be considered high-energy ankle fractures.

Because of the energy required to cause this type of fracture, 25% to 50% of patients have additional injuries that require treatment.



Genu Varum

(Bowling of femur and tibia)

The tibia also known as the shinbone or shankbone, is the larger and stronger of the two bones in the leg below the knee in vertebrates (the other being the fibula), and it connects the knee with the ankle bones. The tibia is found next to the fibula on the medial side of the leg, closer to centre-line. The tibia is connected to the fibula by an interosseous membrane, forming a type of joint called a syndesmosis with very little movement. The tibia is named for the Greek aulos flute, also known as a tibia. It is commonly recognized as the strongest weightbearing bone of the body.





Machinery injury and Metacarpal lengthening

Wrist injuries are common. If a wrist injury causes significant damage to the ligaments, it can result in serious problems in the wrist. Such an injury typically continues to cause problems unless corrected.



Genu Valgum

Genu valgum, commonly called "knock-knee", is a condition in which the knees angle in and touch one another when the legs are straightened. Individuals with severe valgus deformities are typically unable to touch their feet together while simultaneously straightening the legs. The term originates from the Latin genu, "knee", and valgus which actually means bent outwards, but in this case, it is used to describe the distal portion of the knee joint which bends outwards and thus the proximal portion seems to be bent inwards. For citation and more information on uses of the words Valgus and Varus, please visit the internal link to -varus.

Mild genu valgum can be seen in children from ages 2 to 5, and is often corrected naturally as children grow. However, the condition may continue or worsen with age, particularly when it is the result of a disease, such as rickets or obesity. Idiopathic genu valgum is a form that is either congenital or has no known cause.

Other systemic conditions may be associated, such as Schnyder crystalline corneal dystrophy, an autosomal dominant condition frequently reported with hyperlipidemia.





Poliomyelitis

Post - Polio Residual deformity - 5.3 cm shortening

Poliomyelitis is an acute infectious viral disease, spread by the oropharyngeal route, that passes through several distinct phases.

Clinical features:

Typically passes several clinical phases, from an acute illness resembling meningitis to paralysis, then slow recovery or convalescence and finally the long period of residual paralysis.

Early treatment

During acute phase the patient is isolated and kept at complete bed rest, with symptomatic treatment for pain and muscle spasm. Once the acute illness settles, physiotherapy is stepped up, active movements are encouraged.

Late treatment

Isolated muscle weakness without deformity, passively correctable deformity, fixed deformity, flail joint and shortening, all should be addressed according to the need of the patient.



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Congenital Shortening of Left Tibia



Femoral deficiency (congenital short femur)

In its most benign form, femoral dysplasia consists of shortening of the bone with a normal hip and knee. This can be corrected by limb lengthening procedure with Ilizarov technique. If this is associated with coxa-vara a proximal osteotomy may be needed.

Tibial deficiency is very rare, several forms exist and the condition may be associated with other limb abnormalities. Prognosis and treatment depend on the quality of the knee joint. This also can be corrected by Ilizarov fixator.



Bilateral Pes Plano Valgus

with Bilateral Knee Flexion Contractures

Correction of foot deformities (equinus & equinovarus) are based on general biologic laws which permit us to control both tissue genesis and growth, as well as shape forming processes.

1st biologic law (The principle of tension stress) states that gradual traction on a living tissue creates a stress which is metabolically activated and which stimulates tissue genesis and growth through out the distraction period.

The 2nd biologic law states that: the shape forming processes acting upon bone tissue are dependent upon the magnitude of the applied load and the adequacy of blood supply. Hence by applying loads to various parts of the foot we can change the shape and dimension of the bones toward a particular therapeutic goal. This principle allows us to eliminate deformities in children, adolescents and adult.

Equinus and equinovarus deformity develops first in sagittal, then by horizontal and finally in the frontal plane and deformities are corrected in reverse direction i.e firstly in frontal, then in horizontal and lastly in sagittal plane.



Ankylosis at the knee joint capsule. Distended knee. Joint capsule, groove for bone graft, graft inserted, optimal graft shape is visible.



Hockey Stick Deformity

Hockey Stick Deformity (C-type deformity)



Posttraumatic Hockey Stick Deformity needs special attention for correction by ilizarov Technique. Reconstruction and correction can be done simultaneously by this wonderful technique.

Post Traumatic Ankle Deformity

Post Traumatic Rt Ankle Valgus



Reconstruction of the ankle after trauma requires a variety of treatment strategies. Once the personality of the problem is appreciated, a tailored approach may be implemented. The ilizarov method provides a versatile, powerful, and safe approach. It is particularly useful in the setting of infection, bone loss, poor soft tissue envelope, leg length discrepancy, bony deformity, and joint contracture. In this article, a variety of posttraumatic ankle pathologies are discussed. Treatment methods including osteotomy, arthrodesis, distraction, correction of contracture, nonunion repair, and tibia and fibula lengthening are reviewed. The use of the ilizarov method for acute and/or gradual correction as well as the application of simultaneous treatments at multiple levels is discussed in this article.



Foot lengthening



How does limb-lengthening work?

Though medieval torture devices aren't involved, the procedure is arduous and prolonged. A doctor breaks the patient's shin bone and inserts a telescoping rod. Over time, the rod pulls the bone apart very gradually, roughly 1 millimeter a day. As the leg bone is stretched apart, new bone, nerves, arteries, and skin grow to fill in the gap. The whole process takes about three months, followed by several more months of demanding physical therapy. Only a few doctors perform this procedure.



Achondroplasia



This is the most common skeletal dysplasia that we see. The cause is a defect in the FGFR3 gene on chromosome 4 that codes for fibroblast growth factor receptor 3. Endochondral bone formation is most affected and thus the patients presence with disproportionate short stature and classic clinical and radiographic features. The most characteristic feature is that the limbs are disproportionately short compared with the trunk. Relative under development of the foramen magnum and spinal stenosis can cause significant neurological difficulties. Correction of limb alignment may be necessary and the use of limb lengthening by Ilizarov technique is very popular in most of the countries.



Anterolateral Bowing

Congenital anterior or congenital anterolateral bowing of the tibia with partial sclerosis and narrowing of the medullary cavity is always vulnerable to fracture and pseudoarthrosis. Teaching is that the anterolateral type of bowing has a bad prognosis as compared to the posteromedial bowing which is relatively benign in condition, and usually resolves spontaneously as the child grows. Sharrad gives the description of two types of anterior bowing:

1. Benign type:

- a. No stigmata of neurofibromatosis
- b. No fibrous dysplasia
- c. No pathological fracture
- d. Spontaneous correction occurs with aging.

2. Progressive type:

- a. Medullary cavity is narrowed
- b. Medullary cavity may be obliterated
- c. Bone texture is normal
- d. Usually due to neurofibromatosis or fibrous dysplasia in which the deformity slowly increases
- e. Spontaneous fracture with pseudoarthrosis may occur
- f. LLD may be present



Neglected Bilateral CTEV

Clubfoot deformity is the commonest congenital anomaly which has been treated in the past by several methods by several orthopaedic surgeons with variable success. Early treatment of this disorder were manipulative. Several surgical options were also tried by several surgeons later, but the results have not proven to be superior and more complication have been reported after surgical intervention. The number of operations is many, from the minimalist percutaneous TA lengthening, plantar fasciotomies & abductor hallucis resections to small procedures like posterior Attenborough soft tissue release, going on to extensive PMR by Turco. Complete subtalar release by Cincinnati approach probably leave no soft tissues intact around the subtalar joint. Recently a big marketing for external fixation devices - all claiming simplicity and perfect results and are being put on tiny babies feet leading to excellent results. Relapsed, rigid and neglected cases are the best examples. Bones of young plants and saplings grow slowly and it takes many years to see the true results of the procedures we do on growing bones. I.V ponseti has been the pioneer of the manipulation and casting technique and he has practiced and perfected his technique for over 50 years.





TAO

Buerger's disease (thrombo-angiitis obliterans) is an episodic, segmental, inflammatory, and thrombotic disease affecting the arteries and superficial veins of both upper and lower limbs, usually in men between 25 and 40 years of age. It is rare in non-smokers.

The distinguishing features from atherosclerosis include: a more dramatic clinical picture, persistent rest pain, intermittent course, and a greater incidence of gangrene.

Lao Buerger (1879-1943). New York pathologist. described thrombo-angiitis obliterans (inflammation of a vessel with thrombus formation) in 1908.

Introduction:

TAO is a segmental inflammatory disease that most commonly affects the small and medium sized arteries and veins, resulting in signs and symptoms of ischaemia. The etiology of TAO is unknown seen very commonly in smokers.



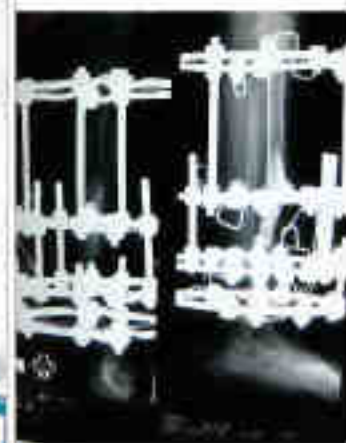
Congenital Pseudoarthrosis of Tibia

Congenital pseudoarthrosis of tibia (CPT)

This is a disease of periosteum. CPT remains one of the least understood, most complex and most difficult to treat of all orthopaedic problems.

Andersons Classification: (Very easy to remember)

- 1) Dysplastic type: The hour-glass constriction of the long bones is characteristic
- 2) Cystic type: The bone is thick and there is a cyst like lesion.
- 3) Late type: Fracture occurs between the age of 4-12.
- 4) Clubfoot type: This is associated with streeters band.





Pes Calcaneus



In humans, the calcaneus is the largest of the tarsal bones and the largest bone of the foot. The tarsal bones of the ankle are arranged in proximal and distal groups somewhat like the carpal bones of the wrist. Because of the load-bearing role of the ankle, however, their shapes and arrangement are

conspicuously different from those of the carpal bones, and they are thoroughly integrated into the structure of the foot. In the calcaneus, several important structures can be distinguished:

Training

Opportunities offered by the method of transosseous osteosynthesis attracts foreign orthopaedic and trauma surgeons.

We are going to organise the several training programs within a short time. A program of training includes lectures, discussions of clinical cases, hands on workshop and live surgeries. The training will be conducted by highly qualified Faculty Members.

1. Academician Prof. D.Sc. V.I. Shevtsov, Kurgan, Russia;
2. Prof. D.Sc. A.V. Gubin, Kurgan, Russia;
3. Prof. D.Sc. Y.P. Saldatov, Kurgan, Russia;
4. Honored Prof. Ph.D. M.M. Ilari.