Editorial

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Main Tendencies in the Development of Contemporary Traumatology and Orthopaedics

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Editorial

The development of the surgical interventions performed on the locomotor system has been closely connected with the development of the human society that has been constantly undergoing changes due to the advances in the production sphere.

Human life became more intensive in the XIX and XX centuries due to the development of mining, metallurgy, automobile industry, city and housing construction, military manufacturing, and construction of powerful electric stations. Despite that such a development has made the human life on the planet more comfortable, the contemporary production spheres have caused several technogenic disasters and an increase in the number and severity of road and work injuries. Natural disasters due to human influence on climate, terroristic acts and military actions in a number of countries add much to the issue of increased traumatism. Modern types of firearms cause a lot of primary bone defects along with other lesions. All the mentioned impacts result in a so called "epidemics due to injuries" that is characterized by a great number of injured persons and a greater degree of the severity of injuries. Moreover, the unexpectedness of the events may lead to a breakdown in the psycho-emotional state of the injured persons.

A mass flow of the injured persons has been arising from the foci of man-made disasters, earthquakes, local war conflicts, and terroristic attacks. They have a great impact on the activities of medical institutions. The injured that arrive experience a strong fear, are extremely excited and demand prompt medical care. Therefore, the medical institutions have to mobilize all their reserves of the staff of trauma surgeons, anesthesiologists, and psychologists, as well as all their material resources. In a number of countries, special medical stations have been organized on the main roads that engage prepared medical workers and material means for rendering medical care on the site to reduce the time since the injury up to a specialized care.

In case of a mass flow of the injured from the focus of destruction, the wounded are divided into two groups. The operative assistance is rendered in a maximum possible volume in those who are in a shock or asphyxia. The available diagnostic and treatment means, devices and bone fixation implants are used. Active anti-shock therapy and other measures are applied. On the contrary, the injured that suffer soft tissue wounds and solitary fractures undergo conservative treatment: Wound dressing, plaster fixation or skeletal traction.

It should be noted that great material resources have been spent lately on the care of the injured persons, and the expenditures have been growing much.

Historically, fracture management is based on the main principles such as bone fragment reduction followed by fixation of the injured segment.

These principles remain up to date. What have changed are the materials and instruments for rendering a primary assistance with conservative or operative means of fracture repair.

Conservative treatment is common in pediatric and geriatric patients and implies fixation with plaster casts, polyurethane bandages, and skeletal traction. The main purpose of skeletal traction is to reduce bone fragment displacement in order to restore the segmental axis and length.

Due to the advances in anesthesiology and surgical techniques for fracture management, the interventions are performed with the use of internal and external fixators.

Screws, plates and intramedullary nails are common internal fixators. Screws provide osteosynthesis of short tubular bones, small bone fragments, malleolar fractures, hand bone or foot fractures. They are frequently used for oblique fractures in long bones wherein the main rule should be observed: The screw should be inserted strictly perpendicularly to the fracture line and must enter into the opposite cortex.

Transverse diaphyseal long bone fractures are fixed with plates. Tight inter-fragmental contact is achieved with compression plates. Curved adapted plates are used for fractures that are close to the articular ends.

G. Küntscher (Germany) proposed his intramedullary nail for bone fragment fixation in 1939. His nail was V-shaped in cross-section. Later, a number of nails were designed that had rectangular, square, round and other types of section views. Clinical practice with the use of intramedullary nails has established their main drawbacks such as a diastasis or residual gap at the fragments junction, possible rotational displacements, deformities, and nail failure. These shortcomings have led to the development of massive rods and nails that were supplied with an anchoring device on one end and a compression device on the other end. I. Kempf and A. Grosse (France) proposed implants for locked intramedullary osteosynthesis in 1985 that has been considered "a gold standard" nowadays.

The tasks that an orthopaedic surgeon should solve are somewhat different. The techniques that have been mentioned above provide bone fragment fixation and stability while in orthopaedic conditions it is necessary to provide a dynamic and controlled fixation as by limb lengthening or deformity correction. External fixation devices serve this purpose. According to their designs, they can be monolateral, bilateral, or circular.

The practice has shown that monolateral fixators are able to provide the required fixation in a static mode. Therefore, their use is mainly indicated for fracture fixation. Their application for limb lengthening may result in secondary deformities due to insufficient fixation rigidity. So, along with them, bilateral fixators have been developed.

In 1936, Josef E. Bittner (USA) proposed a circular fixator and named it "a fracture reducing splint". He used it for reduction of bone fragments in fractures but changed it with a plaster splint after the reduction.

G.A. Ilizarov (Russia) proposed his apparatus and techniques of its use in 1951. The apparatus has gained a wide application in the former USSR. His apparatus became known in the world thanks to Prof. A. Bianchi Maiocchi (Italy). The invention of G.A. Ilizarov stirred the creative thought of a number of authors.

A hinged tangential apparatus was under design in Kurgan (Russia) under the guidance of G. Ilizarov in which the rods were positioned not perpendicularly to the external supports but in a V-shaped mode. The idea was further developed by J.C. Taylor (USA) in 1995. In the following period, the efforts of designers were directed not to the enhancement of the functional possibilities of their constructions but to the change of the supports shapes and to the positioning of rods in regards to the supports. All the devices that were developed later are based on the treatment technologies that had been proposed by G.A. Ilizarov and his disciples. Thus, there has not been a great progress in the treatment techniques in the recent years.

In our opinion, the efforts in the further development of orthopaedic engineering should be focused on improvement and creation of the automated systems for limb lengthening and deformity correction procedures as they produce distraction with a high-frequency rate. This direction will approximate the limb lengthening technology to the natural bone growth.

The fixators, both internal and external ones, will continue to be used in the nearest 20-30 years. However, we believe that traumatology and orthopaedics will change a lot in the future. It will be associated with the use of cell- and nanotechnologies. Once the specific cells are obtained, there will appear an opportunity to have a stimulating effect on the processes that run in the human tissues, i.e., implant osteoblasts for fracture repair and bone lengthening, or specific nerve cells for spinal cord lesions. Biologically absorbable or degradable fixators will be created and widely used. Instead of the surgical interventions that have been applied nowadays, high technologies will be used that will involve the cell-to-molecular level of the human body. Contemporary operations would become history.