MEDICAL-SOCIAL ASPECTS OF EARLY OSTEOSYNTHESIS IN CHILDREN WITH MULTIPLE AND COMBINED TRAUMA

Between 2005 and 2009, 87 children (aged between 3-15 years) with multiple and combined trauma were examined and operated, using the apparatus of external fixation. In 68 (78.2%) of patients, stabilization of bone fragments was performed for the first 2 days of the accident. The study showed that using the early osteosynthesis for treatment of long bone fractures in multiple and combined traumas considerably reduced the time of stay in hospital on average for 12-14 days.

Key words: Pediatric traumatology, multiple and combined trauma, early osteosynthesis, apparatus of external fixation.

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Introduction

According to recent studies, the incidence of pediatric traumatism, particularly the number of associated and multiple trauma, is predicted to increase due to acceleration of life rhythm and pace (e.g., Bond et al., 2005; Segui-Gomez et al., 2003, Yermolov et al., 2003). This is a serious injury and the implications for the society are earnest, as most of the trauma victims are young and at the beginning of their careers.

Puzjitskiy et al. (2009) noted that the treatment of such injuries is followed by many medical and social problems, as either an injured child or patient’s relatives could not benefited from long-term stays in hospital, especially on bed conditions. In this study, the total costs of the treatment is estimated to include the costs of implantants, and eventually to be dependent on the time of stay in hospital, costs of medicines, bandaging means, as well as on the sum, which patients (their parents) receive for a sick-leave (Puzjitskiy et al., 2009).

Compared with developing countries, Taddy et al. (2009) reported that there are economic advantages in Central Europe and the USA due to existing of industrial bases, as the costs of implantants for the treatment of fractures are much lower than one time of stay in hospital.

Results in the last decade have lead to a globally changed conception of operative treatment in pediatric fractures. Today, with good medical control, early osteosynthesis can and should be carried out in associated and multiple trauma patients. There is new terminology - “poor-invasive”, “minimally-invasive”, “biological”, “functional” types of closed osteosynthesis - defining changed concept of fractures operative treatment. Minimally-invasive functional-stable methods of fixation mean cosmetic intraoperative accesses on one hand, and absence of operative access in fracture region on the other, thus, providing no additional traumatization of soft tissues and periosteum. Instead of anatomic reposition, rigid fixation, and interfragmentated compression, surgeons are most benefited from elastic fixation, admitting micromobility of bone fragments (e.g., Puzjitskiy et al., 2009). According to the authors, though external immobilization or apparatus designs are absent, the modern techniques are expected to gain optimal reposition and stabilization of bone fragments, contributing to early rehabilitation onset.

In previous studies (e.g., Kadirova et al., 2001; Kuznechihin et al., 1999), it has been reviewed that in the treatment of associated and multiple fractures of the long bones at
childhood age so far were preferred conservative methods, such as plaster immobilization, skeletal traction, and occasionally the apparatus of external fixation (AEF). At present time, however, for fractures treatment, have been used functionally stable methods, modern antibiotics, advanced operation blocks, finally, new electronic-optical transformers (EOT) with narrow cluster and small doses of radiation, which are available throughout for visualization. Accordingly, for pediatric fractures of the long tubular bones, “the conservative therapy conception” should be under consideration versus the most preferred operative treatment (Puzjitskiy et al., 2009).

Osteosynthesis by elastic nails has great advantages for children and their family: it shortens the period of hospitalization, improves subjective well-being of the patient, insures free movements without plaster bandage, best hygiene, shortens the period of absence at school, etc. Looking after child in coxite plaster bandage would seem to be extremely difficult for parents. Nevertheless, the indications for the operative treatment of diaphyseal fractures of the femur defined by Taddy et al. in 2009 are relative and should be considered with children and their parents.

Additionally, in several studies conducted by Ankin (2004), Greisberg et al. (2002), McLauchlan et al. (2002), successful osteosynthesis is proved to improve chance of survival but also immediate and early restoration of patient’s working ability, to avoid the long-term forced position, to considerably reduce the time of stay in hospital, to shorten the recovery period, etc. Hence, the advantages of early osteosynthesis offer new hope for both the patients and their relatives in terms of improving their quality of life.

In this study, we discuss successful experience with the application of methods of minimally-invasive osteosynthesis in the department of pediatric traumatology of the Republican Scientific Centre of Emergency Medicine of the Republic of Uzbekistan.

**Materials and methods**

Between 2005 and 2009, 87 patients with simultaneous diaphyseal fractures of the long bones and associated injuries of other parts of body (skull, organs of abdominal and thoracic cavity, pelvis, etc.) were examined and operated. 105 patients were conservatively treated.

For the surgical treatment, we applied the АEF, as there is not any industrial base, producing intra-bony implantants in the republic. In children at the age from 3 to 12 years we used the wire-pivotal АEF developed by the Research Institute of Traumatology and Orthopedics of the Ministry of Health Services. In children aged between 12-15 years we applied the pivotal compression-distraction apparatus (PCDA) developed in our hospital (national patent of the useful model No FAP 00407 from 04.09.2008).

On character of installation of external support, the wire-pivotal АEF is a unilateral one-flat device which allows carrying out of compression and distraction due to presence of a junction, which connects two symmetric external supports. The available apertures and fixing bolts on the supports admit to apply both the wires and pivots with a diameter up to 4.0 mm. The use of wire or pivotal kind of АEF depends on patient’s bone diameter, as well as on the muscle system development.

Once the wire-pivotal АEF is used, the operation time does not exceed a mean of 25-30 minutes. Sufficient stabilization of fracture allowed to developing motions in adjacent joints of injured segment for the next day after operation. After 14-18 days, patients walked with crutches and received dosing overload on the affected limb. In addition, for fragmentated (unstable) fractures, significant damages of soft tissues, pain syndrome, local symptoms of injury, and patient’s psychoneurological state, languet plaster bandage immobilization of the limb was performed.

The PCDA developed by us for the treatment of diaphyseal fractures of the long bones has a crossbar with two parts, which connected by compression-distraction screw. Parts of a support crossbar are equipped with two blocks of fixators, each of them consists from a
basic one connected with the support crossbar, and additional fixator connected with the basic and pivotal ones. On character of installation of external support, the device is unilateral two-flat. Additional immobilization by plaster bandage is not required. Independent active movements in the injured extremity are permitted upon the 2-3 day of operation and axial dosing overload after 7-10 days.

**Results and discussion**

In 68 (78.2%) of 87 associated and multiple trauma patients, who had undergone surgical treatment, we performed stabilization of bone fragments for the first 2 days of the accident. It should be noted that the earlier surgical intervention having been carried out, the more precisely and easily reposition of bone fragments was done. All patients achieved consolidation of fracture after a mean of 5-8 weeks of trauma. The process of reparative regeneration in a zone of bone injury corresponded to its usual course and was accompanied by complete restoration of motions volume in adjacent joints.

**FIGURE 1-A. STRAIGHT ROENTGENOGRAM OF THE RIGHT FEMORAL BONE ON THE TIME OF ADMISSION**

**FIGURE 1-B. STRAIGHT ROENTGENOGRAM OF THE LEFT FEMORAL BONE ON THE TIME OF ADMISSION**

**FIGURE 1-C. STRAIGHT ROENTGENOGRAM OF THE FEMURS AFTER OPERATION**

**FIGURE 1-D. STRAIGHT ROENTGENOGRAM OF THE FEMURS AFTER 6 WEEKS OF TRAUMA**
For the clear compare, we result two case reports: 1) An 11-year-old girl, who had admitted to the clinic in 30 minutes after trauma, under clinical-X-ray examination, was making a diagnosis: Multiple trauma. Closed transversal fracture in the middle third and lower third limits of right femur with displacement of bone fragments. Closed oblique-transversal fracture in the middle third and lower third limits of left femur with displacement of bone fragments. Figures 1-A and 1-B show X-ray imaging of fractures of the right and left femurs on the time of admission, at frontal planes, respectively.

After 1.5 hours of the time of admission, under EOT, we gradually performed manual reposition of bone fragments of the right and left femurs, and closed osteosynthesis by wire kind of the AEF. Figure 1-C illustrates X-ray view of the femurs after operation, at frontal planes.

For the joints of the affected limb, physical exercises were started upon the 2nd day of trauma. After 5 days of stationary treatment, the patient followed-up in out-patient conditions. Walking with crutches and dosing overload on legs were admitted after 7 days, without crutches - over 21 days. In 45 days after trauma, the patient achieved precise correction of the mechanical axis, fracture adhesion, and complete restoration of function of the lower limbs (Figure 1-D).

2) An 8-year-old boy was referred to the clinic in 1 hour after the incident. Under clinical-X-ray examination, he was diagnosed: Associated trauma. Closed head trauma. Commotio cerebri. Closed transversal fracture of the middle third of the left femur with displacement of bone fragments (Figure 2-A).

For 2 hours after the time of admission, under EOT, manual reposition of bone fragments of the left femur, and osteosynthesis by PCDA for the treatment of diaphyseal fractures of the long bones were done (Figure 2-B).

Physical exercises for the joints of the affected limb were started upon 2nd day of trauma. After 7 days of the time of stay in hospital, the patient followed-up in out-patient conditions. Walking with crutches and dosing overload on legs were started after 14 days, without crutches - over 28 days. Precise correction of the mechanical axis, fracture
adhesion, and complete restoration of function of the left lower extremity were marked after 8 weeks of trauma (Figure 2-C).

The study of dynamics of the time of stay in hospital showed that its parameter was a mean of 10.1 days. In patients, who operated in early terms, this parameter was 8.5 days, and in those treated in late periods was 14.5 days, accordingly. Patients, who treated conservatively, stayed in hospital over a mean of 22 days. This analysis has noted that the use of early osteosynthesis for fractures of the long bones in associated and multiple traumas considerably reduced the time of stay in hospital in dynamics. In this occasion, early osteosynthesis plays a positive socioeconomic role for each family suffered from trauma.

**Summary**

According to available data and the author’s own clinical experience, early osteosynthesis is effective in the treatment of pediatric associated and multiple trauma children. As a result, use of the suggested treatment method could avoid traumatic expensive surgical interventions (open reposition, intramedullary, periosteal osteosynthesis, etc.), diminish long-term stays under skeletal traction, especially when there are two or more children in family, and reduce the time of stay in hospital up to a mean of 12-14 days, that is important for the budget of patient’s family.

**References**


