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DAMAGE CONTROL IN CHILDREN'S POLYTRAUMA CASES

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The authors describe their experience in treatment of fractures in cases of serious polytrauma using the method of traumatological damage control (DC). The advantages of external fixators for both temporary and permanent stabilization of long bone fractures in patients with ISS 40 (Injury Severity Score) were demonstrated on the group of 69 polytraumatized patients, treated in the Trauma Centre of the University Hospital in Ostrava in the years 2002-2004. The method was used in 30 patients with fractures of long bones and pelvis and no case of perioperative impairment to health was noted.

INTRODUCTION

Growing number of high-energy accidents in children with high quality pre-hospital medical care and with fast transport to traumatology centers results in the increase in number of transported severe polytrauma cases with ISS (Injury Severity Score) higher than 40 points. Whereas in polytraumas with ISS lower than 40 and in severe monotrauma cases or in combined injuries of extremities early total care principles of definitive treatment of fractures are gaining prominence in recent years, which brings about decrease in number of complications of fracture healing as well as lower infection incidence, Trenz (1993) proved that he had achieved better treatment results in polytraumas with ISS higher than 40, where definitive stabilization of long bone fracture is delayed. Therefore for those polytraumas in the first stage he recommended temporary stabilization of long bone fractures via external fixation as provisional stabilization - damage control orthopedic (DC) and definitive osteosynthesis only after overall stabilization of health status of polytraumatized patient. Bossi and Kellama came to similar conclusion [1, 2].

METHODOLOGY AND CLINICAL POPULATION

From 2002 to 2004 330 polytrauma cases with ISS higher than 17 were treated in thetraumatology centre of teaching hospital with polyclinic in Ostrava (tab. I), of which 69 were children.

Table I.
Polytrauma cases in 2002-2004

ISS	Total number	Children
17–25	209	16
26–39	124	20
ISS >40	97	33

The most frequent mechanism of trauma in children was car accident, they also were injured as pedestrians or cyclists. The number of injuries after fall from heights is growing, mainly in children of up to three years of age.

The most frequent injury in children was CNS in 73%, followed by thorax injury in 54% and abdomen injury in 52%. Injury of pelvis with haemodynamic instability occurred in 10% of polytrauma cases. Injuries of

extremities occurred in 63% of polytrauma cases (tab. II).

Table II.
Incidence of system affection in population

CNS	73%
Thorax	54%
Abdomen	52%
Extremities	63%
Pelvis	10%

19% of fractures were compound fractures. In treatment of fractures in polytrauma cases with ISS lower than 40 early osteosynthesis (ETC) was performed using methods of miniinvasive osteosynthesis (MIO). In closed and opened injuries of 1st and 2nd degree the most frequent was elastic intramedullar osteosynthesis and in opened fractures of the 3rd and 4th degree osteosynthesis by means of external fixators, mostly of circular type (MCD Ostrava - modified compression-distraction apparatus) (fig. 1, 2).

The external fixators of MCD type proved to be useful not only for temporary fixation of fractures within damage control, but also for definitive stabilization of fractures because this type of fixator enables gradual reposition of fracture and its stabilization with axial and transversally lateral compression, which we use to advantage mainly in opened fractures and intraarticular fractures (fig. 3 a, b, c, 4) [3, 4, 5, 6].

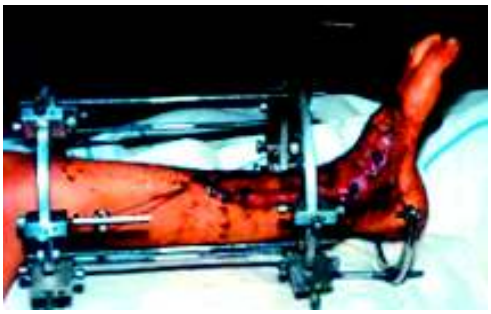
DISCUSSION

Concept of treatment of fractures in polytrauma of adults and children is in constant development from the technique of complete treatment (ETC) to traumatic surgery with damage control (DC - damage control orthopedics). In the past negative influence of a fracture on organism response was emphasized, which led to the concept of definitive treatment of long bone fractures (ETC) using miniinvasive biological osteosynthesis that resulted in a decrease of ARDS complication and multiorgan failure [7, 8, 9, 10, 11, 12, 13]. In critical cases of polytrauma with ISS higher than 40 it is recommended to treat fractures by means of external fixation (provisional stabilization) and to postpone the definitive treatment of fracture after stabilization of overall status of the injured [14].

Indication of damage control orthopedic surgery in infantile polytrauma cases [3, 6, 15]:

1) polytrauma with ISS >40,
2) polytrauma with ISS >20 with thorax injury (AIS >2),
3) polytrauma with abdominal and pelvic injury (Moore grade >3), hemorrhagic shock TK <90,
4) bilateral pulmonary contusion on pulmogram,
5) initial average pressure of pulmonary artery >24 mmHg.

The best way to stabilize the fracture is by means of external fixators, which can be applied quickly in operating theatre or in an intensive care unit, but also during definitive fracture fixation, if condition of the patient aggravates [4, 5]. All authors agree on the fact that damage control traumatic surgery requires thorough observation of organism response to the trauma with necessity of early stabilization of fractured long bones, which is rudimental for improvement of physiological traumatic reaction of a child and of his or her preparation for definitive fracture treatment [16, 17]. DC is therefore indicated for injured children with one or more fractures of long bones complicated by severe multisystem trauma with hemorrhagic shock, pulmonary contusion with hypoxia, oliguria, increased interleukin 6 and severe head injury. Definitive treatment is then performed usually 6-8 days after the injury, when the state of health of the child has already been stabilized.



Ryc. 2. Możliwości zastosowania osteosyntezy w złamaniach otwartych
Fig. 2. Possibilities of osteosynthesis in opened fractures

Ryc. 1. Możliwości zastosowania osteosyntezy w złamaniach zamkniętych
Fig. 1. Possibilities of osteosynthesis in closed fractures

Ryc. 3 a. Mnogie obrażenia ciała
Fig. 3 a. Multiple body injuries

Ryc. 3 b, c. Zastosowanie aparatu dystrakcyjnego do leczenia złamań w mnogich obrażeniach ciała
Fig. 3 b, c. Use of distractive apparatus to treatment of fractures in multiple body injuries

Ryc. 4. Zastosowanie aparatu dystrakcyjnego w złamaniach przezstawowych
Fig. 4. Use od distractive apparatus in trans-articular fractures

Ryc. 5. Zastosowanie zewnętrznego stabilizatora pierścieniowego do leczenia złamań otwartych w mnogich obrażeniach ciała
Fig. 5. Use of external circumferencjal stabilizator to treatment of opened fractures in multiple body injures

CONCLUSION

In traumatology centre of teaching hospital with policlinic in Ostrava we have been trying for 10 years in severe polytraumatic children to stabilize fractures by external fixators using Dynafix PK for fractures of pelvis and external circular fixators for fractures of upper and lower extremities concurrently in team cooperation most frequently with neurosurgical team during CNS treatment (fig. 5).

In the last two years we also use pelvic clamp for temporary stabilization and for treatment of femur fractures in proximal part we use unilateral external fixator. In other types of fractures we use simple circular external MCD fixators firstly as a temporary stabilization, where we fix Ki wires only into marginal circles of MCD apparatus and after stabilization of overall condition of patient we perform additional fixation for definitive fracture stabilization after application of extensible Ki wires into central circles of MCD apparatus. These extensible Ki wires enable additional fracture reposition and stabilization of individual fracture interfragments with their transversally lateral compression. With regard to the fact that in 20 years of practice we did not observe deterioration of health status of any polytraumatized child during acute application of external fixator, we try to apply in all polytraumatic cases external fixators acutely in multilateral cooperation with concurrent treatment of life threatening injury.

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KONTROLA CIĘŻKOŚCI URAZÓW U DZIECI Z MNOGIMI OBRAŻENIAMI CIAŁA

Słowa kluczowe: kontrola ciężkości urazów, mnogie obrażenia ciała, złożone złamania.

Autorzy przedstawiają swoje doświadczenie w leczeniu złamań w przypadkach ciężkich, mnogich obrażeń ciała z zastosowaniem metody kontroli ciężkości urazów (DC). Wykazano korzyści płynące z czasowego i stałego zastosowania zewnętrznych stabilizatorów w złamaniach kości długich u 69 dzieci z mnogimi obrażeniami ciała i skalą ciężkości urazu 40 (ISS), które były leczone w Centrum Traumatologii Szpitala Klinicznego w Ostravie w latach 2002-2004. Metodę kontroli ciężkości urazów zastosowano u 30 spośród pacjentów ze złamaniami kości długich oraz miednicy i w żadnym przypadku nie stwierdzono okołooperacyjnego pogorszenia stanu zdrowia.

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