CLINICAL AND DIAGNOSTIC ASPECTS OF TREATMENT OPTION FOR MULTIPLE FRACTURES OF LONG BONES IN CHILDREN

This article provides retrospective analysis of examination and treatment of 204 children aged from 2 to 15 years old, who were hospitalized to the Research Institute of Traumatology and Orthopaedics (Uzbekistan) with multiple fractures of long bones of the extremities during the period from 2000 to 2010 years. The results showed that the largest reserve in improving of local treatment outcomes is hidden in the rational use of local dynamic strategy (by reducing its share) and local closed operational tactics (by increasing its share). A large reserve to improve common outcomes of treatment is hidden in the rational use of conservative combined and dynamic tactics, as well as in reducing of proportion of conservative tactics and increasing of share of operational strategy in general.

Keywords: Pediatric multiple fractures, assessment of injury severity, treatment.

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Introduction

Pediatric multiple fractures of long bones according to different authors (Akhundov et al., 1971; Merkulov et al., 2003) amount from 1.3% to 8% of all fractures of long bones. The main group of pediatric multiple fractures are the damages of upper extremities, which are observed from 38.7% to 62.4% of cases (Bahtiozin et al., 1988; Jalilov et al., 1992; Merkulov et al., 2003; Ter-Yegiazarov et al., 1982). Accordingly, the majority of victims are children of older age groups (Yakhyayev et al., 2009).

Diagnosis for fractures of this localization is carried out by clinical and radiological data. It has its own characteristics in the study of patients with multiple injuries of the extremities (Nikitin, 1969). The main purpose of diagnosis for multiple fractures is to determine the severity of the total impairment of organism, as well as the severity of individual local fractures, including the degree and nature of displacement of fragments, as these data become the basis for determining treatment strategy and the choice of conservative or operative therapy.

In this aspect, it is promising to use clinical scoring scales, which in recent years become widely used in the practice of traumatologists-clinicians and researchers (Baker et al., 1974; Champion et al., 1983; Karlbauer et al., 2003; Sokolov, 2006). At the same time, the developed and used for multiple fractures clinical point scales are not applicable for the choice of local treatment tactics (conservative or operative), as they are focused mainly on the total damage severity of organism, and not on the local status of individual zones of destruction. Lisenko et al. (2000) noted their low diagnostic efficiency in patients with multiple injuries (polytrauma).

The main approaches to the treatment of multiple fractures include quite wide selection of conservative and operative treatment methods. On the one hand, this expands the therapeutic possibilities for traumatologists, on the other one, greatly complicates the choice of rational treatment strategy. For individual local fractures in multiple injuries, the question of applicability of the same tactical approaches, which are used for isolated fractures, is not well studied. In particular, in children, due to high reparative capacity of their organism, conservative methods of treatment are more commonly used than in adults. However, the questions “How the reparative opportunities of children in multiple injuries were changed?”, and, correspondingly, “How widespread use of conservative treatments in this contingent of patients is proved?” remain understudied.
In connection with the abovementioned, the purpose of this study was to develop rational approaches to treatment option for children with multiple fractures of long bones through the development of clinical score scale and retrospective analysis of treatment results for different variants of conservative and surgical therapy.

Materials and methods

We carried out a retrospective analysis of the results of examination and treatment of 204 children aged from 2 to 15 years old, who were hospitalized to the Research Institute of Traumatology and Orthopaedics of Uzbekistan for multiple fractures of long bones of the extremities during the period from 2000 to 2010 years.

In 198 cases were fractures in two segments, in 6 cases - fractures of three segments. Altogether 204 suffered children were affected 414 segments, including 334 (80.7%) in the upper extremities, and 80 (19.3%) in the lower extremities. Table demonstrates the distribution of lesions of individual segments in patients.

<table>
<thead>
<tr>
<th>Segment</th>
<th>Thigh</th>
<th>Lower leg</th>
<th>Foot</th>
<th>Heel</th>
<th>Shoulder</th>
<th>Forearm</th>
<th>Brush</th>
<th>Clavicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>32</td>
<td>32</td>
<td>10</td>
<td>6</td>
<td>111</td>
<td>212</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Frequency, %</td>
<td>7.7</td>
<td>7.7</td>
<td>2.4</td>
<td>1.4</td>
<td>26.8</td>
<td>51.2</td>
<td>1.9</td>
<td>0.7</td>
</tr>
</tbody>
</table>

As it seen from the table, among all segments most often were affected forearm (51.2%), shoulder (26.8%), third place in frequency occupied thigh (7.7%) and lower leg (7.7%).

Among 204 children, 168 (82.4%) were boys, 36 (17.6%) - girls. The average age of children was 10.0±0.21 years old. The average period from the date of injury before admission to the hospital was 6.4±1.05 hours. There was no serious shock state in the children admitted.

Patients had primary care and emergency room examinations, if necessary anti-shock measures, and within the first 48 hours primary treatment strategy was determined. At this stage, when necessary and were direct indications, we did surgical interventions. However, primary conservative measures were basic therapy method. According to the results of conservative treatment, based on its effectiveness (the degree of reposition, fixation stability of bone fragments), in a period of 3 to 7 days we determined secondary treatment strategy.

Secondary treatment strategy was divided into local and common. Local treatment tactics (LTT) was a tactics for separate affected segments, regardless of treatment strategy for other injured segments. Common treatment tactics (CTT) was a tactics of treatment in general, taking into account all the affected segments.

On the degree of activity of local tactics, we have identified the following five tactics (in ascending order of activity):
- Conservative: (1) static passive; (2) static active; (3) dynamic;
- Surgical: (4) operational closed (extrafocal and focal); (5) operational open.

When analyzing the treatment results by segments, in accordance with these tactics, we isolated the groups of treated segments.

On the degree of activity of common tactics, we have defined the following eight tactics (in ascending order of activity):
- Conservative: (1) static passive; (2) static active; (3) static active-passive; (4) dynamic; (5) combined and dynamic;
- Surgical: (6) middle operational (1 segment was operated); (7) active operational (2 segments were operated); (8) total operative (all affected segments were operated).

In our observations we used only 6 of 8 types of CTT.

Because of absence of an integrated system of clinical scoring assessment, which would allow quantitative evaluation of injuries severity in multiple fractures of long bones in children at the time of admission, at discharge and later periods, one of the objectives of the study was to develop such a system. We first identified the main requirements for this system:

1. possibility of differentiated approach to the choice of treatment tactics (conservative, surgical, etc.) based on quantitative evaluation of the initial state (injury severity);
2. possibility of quantitative evaluation of immediate results of treatment;
3. ability of quantitative assessment of final treatment outcomes;
4. possibility of use in the departments of Traumatology in hospitals of all levels, from Central district and Central municipal hospitals (CDH/CMH).

To meet these requirements, the parameters of scoring system for the test material should have the following properties:

- variability coefficient of resulting estimation based on the results of evaluation of individual cases should be from 50% to 100%;
- maximum number of points (levels, grades, ranks) on the scale should be more than 6 (because of 6 treatment tactics), but preferably not more than 10-20, for more simple, but fairly accurate estimation.

In the system of clinical scoring assessment of local and common injury severity applied at the time of admission, the main features for point evaluation scale of the local injury severity, which we called “Local Status” (LSt), 3 categories of displacement has been allocated - on the width, angle and length, and also from 2 to 3 gradations of these symptoms were determined. The total value of LS index is determined by the total score for all three types of displacement; its maximum value is 8 points.

One of the features of multiple fractures is that the fractures in the adjacent segments of one limb there is a problem of instability of middle segment between fracture zones, and also develops identified by us a syndrome of “mutual aggravation” that makes for a more active treatment strategy. Therefore, for the estimation local severity, except displacement, we have introduced another parameter - “Volume of Local Lesions” (VLL). Its value is 1 point for fracture in one limb, 2 points for two or more fractures on one limb.

The total parameter which characterizes the local injury severity of the segment we called “Local Severity” (LS), which is defined as the sum of LSt and VLL. Thus, the maximum value of LS is 10 points, minimum - 1 point. Range of variability of the scale is 10 points, variation coefficient - 100%.

To assess the total severity of lesions on the basis of LSt and LS parameters, we have developed another two parameters - “Middle Local Status” (MLSt) and “Middle Local Severity” (MLS). These parameters are defined as a mean arithmetic value of LSt and LS parameters of all affected segments. Maximum, minimum values, variability range and variation coefficient in MLSt and MLS parameters are the same as in LSt and LS ones. In LTT determining, the main parameter is LSt, whereas in CTT determining the main indicator is MLS.

**Results and discussion**

The results of treatment were studied at discharge of patients from hospital (immediate results), as well as in the period from 2 months to 10 years after treatment, the average period of observation is 4.9±0.30 years.
In the system of clinical scoring assessment of the residual level of lesion and treatment outcomes in the nearest terms (at discharge) developed by us, used the same scale as that on admission, with the addition a letter R (residual) to abbreviation of the parameters - LSt-R, MLSt-R.

Based on estimation of LSt-R parameter, taking into account the number of signs analyzed at the time of discharge, we have developed a system of 5-point evaluation of the immediate results of treatment for individual affected segments. L-EIR parameter (local evaluation of immediate results) obtained in this case based on an analysis of local status on the following characteristics: anatomy, function, complications, need for additional treatment. Common evaluation of immediate results (C-EIR parameter) is carried out by calculating the average values of L-EIR.

When designing a system of clinical scoring assessment of final (remote) treatment outcomes, we used the 8 most important attributes. Each attribute was evaluated by 2-3 points, maximum total score was 20 points. This index received an abbreviation of LSE (local score evaluation). On this parameter is calculated another parameter ASE (average score evaluation) by summarizing LSE of all affected segments and dividing the results by their number.

Taking into account that the assessment was conducted by the level of residual pathology, it was possible to carry out normalizing by matching each value to a level of 100%, i.e. to highest possible level of injury severity. The value obtained was normalized as a percentage of the maximum possible value by multiplying the results in scores by 5%. This is a level of scale precision obtained by dividing the maximum value of 100% on 20 points. Normalized parameters received abbreviations L-NSE (local normalized score evaluation) and A-NSE (average normalized score evaluation).

Taking into account that the conventional assessment of final treatment outcomes is usually a traditional 5-point evaluation (excellent, good, satisfactory, unsatisfactory, bad), based on the above scoring, we also developed criteria for evaluation of final outcomes by 3 signs - anatomical and functional status, social-household status, needs in further treatment. The corresponding parameters received abbreviations L-AFO (local assessment of final outcomes) and C-AFO (common assessment of final outcomes).

Analysis of clinical material was carried out using the system of score scales developed, separately for the segments and separately for the patients.

In our observations, conservative treatment was prescribed for sufficiently severe defeats, in some cases at LSt level up to the maximum of 8 points. Although in many cases this could achieve satisfactory or good treatment outcomes, however, in some cases the results were unsatisfactory, i.e. there was not possible to get a guarantee of successful outcomes after the use of conservative tactics at high values of LSt and MLS parameters.

We also attracted our attention to enough long period of hospitalization - more than 15-20 up to 30-40 bed days, at dynamic conservative and surgical tactics. Long periods of hospitalization during dynamic conservative tactics (skeletal traction) are understandable, since this kind of treatment may be conducted only in the hospital until the formation of callus.

The results of analysis show that in general the surgical treatment of children with multiple fractures of long bones appeared on outcomes less effective, compared to conservative, that to some extent contradicts the conventional views. We attribute this, at first, with more severe initial state of the operated patients, and secondly, with the irrational choice of common treatment tactics.

It should be noted that our observations do not mentioned specific differentiation to the choice of treatment tactics, according to initial injury severity - as conservative, as surgical therapy was performed at the levels of LSt parameter from 2 to 8, MLS parameter from 3 to 10, i.e. almost at the entire range of severity.
Conclusion

According to the results of our study, the largest reserve in improving of local treatment outcomes is hidden in the rational use of local dynamic strategy (by reducing of its share) and local closed operational tactics (by increasing of its share). A large reserve to improve common outcomes of treatment is hidden in the rational use of conservative combined and dynamic tactics, as well as in reducing of proportion of conservative tactics and increasing of share of operational strategy in general.

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