

SURGICAL TREATMENT POSTTRAUMATIC “COMPLICATED” CUBITUS VARUS OF THE CHILDREN

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ARTICLE INFO

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DOI: <http://dx.doi.org/10.15520/ijmhs.2015.vol5.iss3.56.103-106>

ABSTRACT

Since 1998 to 2013 we have treated 222 children and teenagers at the Department of Children’s Traumatology of Scientific Research Institute of Traumatology and Orthopedics under the Ministry of Health of the Republic of Uzbekistan with “complicated” varus deformations of elbow joint by application of the different types of osteotomy. For all children we observed a good function of the elbow joint with full range of motions. The average size of preoperative humero-ulnar angle of the deformed elbow joint was -24° (from -8° to 46°), and postoperative humero-ulnar angle of the deformed elbow joint made $-4,5^{\circ}$ (from $+2$ to -11). Based on the analysis of the immediate results and late fate 187(84.2%) of children have the excellent indicators and - 35(15.8%) of the patients have good indicators.

Our fixation method with the use of the Kirschner’s wire and Ilizarov’s apparatus with 2 rings was modified in order to increase stability and functionality of osteosynthesis. It gives the opportunity of anatomic functional recovery under correction of the varus deformation of the elbow joint of the children.

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INTRODUCTION

Posttraumatic elbow joint deformation is the most widespread complication appearing after the transcondylar and supracondylar fractures of the children’s humerus [2,3,6,8].

Overestimation of the child’s organism capabilities by many surgeons and traumatologists [4,9] is one of the causes of posttraumatic elbow joint deformation. Some traumatologists, obviously overestimating the child’s bone capabilities, are neglecting significant deflections resulting in high-grade deformations and chronic restriction of motions in the elbow joint.

Along with that, the analysis of existing literature demonstrates the poor awareness on the high relevance of complicated varus deformations of the elbow joint accompanied with the elbow joint contracture, “supracondylar” syndrome and peripheral neurovascular modifications. Their treatment result is often unsatisfactory since correction is either insufficient or absolutely lost. The mangelon in the lateral elbow cubitus remaining after the surgical correction also creates the basis for the poor cosmetic result [1,6,9].

Up to now there is no common view on the terms and size of correcting osteotomy in case of varus deformation posttraumatic with “supracondylar” syndrome of the children’s and teenagers’ elbow joint requiring surgical correction.

Deformation is often limiting the elbow joint motions, but parents and children are frequently complaining only about cosmetic defect. Plenty of surgical

techniques, including wedge, rhomboid, trapezoid, copular and the other types of osteotomy have been described [1,3,4,6,7,8]. A number of bone-holding units, including wires, bows, bolts, sheets, strands and allochtronic units of various designs have been applied [1,7,8,9].

Improvement of the results of posttraumatic varus deformations of the children’s and teenagers’ elbow joint through application of the cutting-edge research methods and development of differential approach to the surgical treatment is the **goal** of our study.

MATERIALS AND METHODS

Since 1998 to 2011 we have treated 222 children with the varus deformation of elbow joint with application of the various types of osteotomy.

All visiting children with posttraumatic varus deformation of the elbow joint passed through the clinical, X-ray, densitometric, ultrasound (US), computer tomography (CT), MRT and functional methods of examination.

We used measuring the physiologic valgus axis on unaffected limb and the varus deformation of the elbow joint on deformed upper limb. Physiologic valgus on unaffected limb was considered as the “positive” (+) and pathological varus deformation of the elbow joint – as the “negative” (-) one. Required extent of correction was calculated through summation of valgus angulation of unaffected side with the varus angulation of deformed side. We called this angle as the “angle difference” between unaffected and deformed upper limb. The angle difference

is very important in correction of deformed limb, in particular, in evaluation of the late fate and comparison with unaffected limb.

Moreover, we suggested the term “supracondylar syndrome”. In case of the varus deformation of the elbow joint the “supracondylar syndrome” means the following. In case of high-grade (over 30°) and complicated children’s varus deformations of the elbow joint, the highly emerging and deformed lateral epicondylus of humerus and local osteoporosis in external epicondylus of humerus are identified and clinically it is evident as abnormality caused by the tension of lateral collateral ligament of the elbow joint. We called this combination of symptoms as the very “supracondylar syndrome”. We have not found this symptom in domestic and foreign literature. Along with that, it is very important in surgical correction of this abnormality.

Besides, the varus deformation with flexion or extensive elbow joint contractures were found in the course of our study due to the anticurve or recurve deformation of the humerus distal edge. In such cases, specifically in case of recurve deformation of the humerus distal edge, first of all, the joint hyperextension appears, and later on – its instability. We had called the combination of these symptoms as “complicated” elbow joint varus deformation and our studies were also devoted to this abnormality.

The number of results of the X-ray examination of this cohort of patients was analyzed for identification of the reason of this syndrome.

We have developed and suggested evaluation criteria for the severity of the posttraumatic elbow joint varus deformation depending on deformation angle and clinical signs of the elbow joint deformation (DGU 2007 0040 PV RUz of 28.05.2007).

We used the new type of supracondylar correction osteotomy for correction of “supracondylar syndrome” in elbow joint varus deformation with bone-holding with the decussated wires along with osteosynthesis with G. Ilizarov’s apparatus.

Anatomic and functional correction of the elbow joint was the goal of operation. The full-scale X-ray filming of both upper limbs in position of full extension in the elbow joint and maximal forearm supination was completed before the planning of osteotomy type. Both upper limbs of all patients were measured for comparison of physiological valgus on unaffected side and varus deformation of affected limb.

Varus angulation correction. The skiagraph was reflecting the osteotomy scheme; humero-ulnar angle in deformed and unaffected elbow joints was calculated. The deformed side difference was put on paper from the X-ray film.

Based on the X-ray data, we have identified this syndrome appears in case of transcondylar humerus fractures with high-grade remaining dislocation with rotational component.

We split the patients by 3 (I-II-III deformation degree) depending on deformation angle, clinic and X-ray signs. First two groups (I-II deformation degree) of children had the “common” varus deformation. The third group of children had the elbow joint varus deformation with “supracondylar syndrome” and anticurve and recurve multiplanar deformations of the humerus distal edge. They are determined as the groups of “complicated” elbow joint varus deformation.

87 children arrived from the district hospitals after the numerous attempts of the closed reduction during first two weeks after the trauma or after the poor manipulations of tabibs were included in the major group (III deformation degree). X-ray data analysis demonstrated this syndrome had appeared in case of transcondylar humerus fractures with high-grade remaining dislocation with rotational component.

Given the above classification, we launched the search of the optimal treatment options and differential approach to the surgical treatment of this cohort of patients for correction of the various types of the elbow joint varus deformation.

The supracondylar correction osteotomy with consistently functioning osteosynthesis in Ilizarov’s apparatus was developed and introduced in our clinic. Developed method is as follows: the humerus distal metaphysic is opened subperiosteally with posterolateral cut in the lower third of the arm with the length of 5-7 cm, layer-by-layer without separation but with moving away of the triceps muscle of arm. Then, the correction angle is identified via the awl and the holes are made with the burr. After that, the holes are connected with the help of chisel and correction osteotomy is accomplished in the frontal plane in form of triangular – cone osteotomy.

Osteotomy in order to correct the antero-posterior and lateral deformations and creation of physiological anticurve of the humerus distal edge is carried out as the second stage. For this purpose, the osteotomy in sagittal plane is made through the marginal osteotomy of anterior walls of the humerus distal edge cortical layer.

After correction of all types of deformation in two planes and bone fragment reposition they are fixed with two crossed Kirschner’s wires with stop surface. The stitches are put layer-by-layer on the wound. In order to put the Ilizarov’s apparatus, the third wire is put through the olecranon bed of ulnar bone and the last, forth wire – through the mid-upper third of ulnar bone in the frontal plane. The Ilizarov’s apparatus is assembled from 2 semi-rings, and two supporting arms with the wire holders are fixed on the ring. After this apparatus assembling, compression through the tension of upper ends of both wires is carried out and counter-collateral compression is created.

RESULTS AND THEIR DISCUSSION

The results were evaluated both in clinical and X-ray terms with the use of developed by us criteria. The clinic criteria included extent of motions after the operation and availability of complications. The X-ray criteria included the volume of the varus deformation correction (post-operational humero-ulnar angle) and lateral eminence availability.

Clinic example. Patient S. 13 years old, Med.Rec.#250. Was admitted with complaints about deformation and restriction of the left elbow joint flexion. From anamnesis: the patient was injured 4 years ago and treated with the plaster bandage with diagnosis: closed transcondylar fracture of the left humerus with the bone fragment deflection. After the plaster bandage removal some deformation was identified along with extension and flexion contracture in the elbow joint. Locally: the high-grade varus deformation of the elbow joint is identified on examination (-48°), physiological valgus on unaffected limb (+4), “Angle Difference” is equal to 52 degrees. The flexion of elbow is equal to 50° (пaцм-В), the elbow extension -

165° (d), extent of motion - 115. The operation was done – Sypracondylar Correction Osteotomy of the left humerus according to the clinic method along with osteosynthesis with Ilizarov’s apparatus from 2 semi-rings. During postoperative period, the humero-ulnar angle approached the unaffected limb indicators (-4 degrees). The angle difference was equal to 0 degree. Diaphysial – glanular angle in sagittal plane was equal to 42 degrees (on unaffected side - 42).

On the final examination in the mid terms 16 months (from 12 to 36 months) after operation, the results with 187 children from 222 (84.2%) were considered as excellent, and with 35 (15.8%) – as good ones. All osteotomies grew back together within 3 – 4 weeks after operation. The mean value of postoperative humero-ulnar angle of deformed elbow joint accounted for -4.5° (from +2 to -11). The mean humero-ulnar angle on unaffected side accounted for -9° (from -2 to -16°) of physiological valgus.

In our studies we compared our methodology with the other types of osteotomy in cosmetic terms. Several types of supracondylar osteotomy were applied in the clinic for correction of this type of deformation. The cone osteotomy in line with Bairov’s method + osteosynthesis with Ilizarov’s apparatus was applied for 19 (8.6%) children and teenagers, rhomboid osteotomy – for 21 (9.5%), trapezoidal osteotomy – for 29 (13%), supracondylar osteotomy in line with Gulyamov’s method – for 66 (29.8%) and proposed correction supracondylar osteotomy – for 87 (39.1%) children and teenagers.

We believe proposed methodology has the number of advantages against the other types of osteotomy.

- Osteotomy is carried out in supracondylar area and does not cause restriction of the motions in the elbow joint;
- This correction osteotomy enables single-step elimination of all types of deformation of the humerus distal edge; proposed methodology ensures good cosmetic and functional treatment results;
- This type of supracondylar osteotomy can be applied for “complicated” varus deformation with “supracondylar” syndrome and recurve, anticurve multiplanar deformations of the humerus distal edge and the elbow joint contractures;
- Application of Ilizarov’s apparatus ensures better fragment fixation and stability and provides opportunity of early joint development.

In the course of the treatment result analysis, the humero-ulnar angle, in average, was equal to -19° (from -46 to -8) before operation, in the postoperative period it accounted for -3.5° (from +2 to -9). After correction no one child had external epicondylus eminence exceeding 5 mm and not one patient had restriction of motions in the elbow joint. Benchmarking assessment of immediate results and the late fate of the surgical treatment of 222 patients – children and teenagers has demonstrated that proposed methodology is the most efficient one in case of “complicated” varus deformation of the children’s elbow joint, both in anatomic functional and cosmetic terms. Examination of 194 (87.4%) in 3 – 6 months enabled clinical detection of the lack of the elbow joint deformation, and during 2 – 5 years the axis of the upper limb remained correct and the elbow joint function remained to the full extent. The excellent results were obtained with 187 (84.2%) and good ones - with 35 (15.8%) children.



a



b



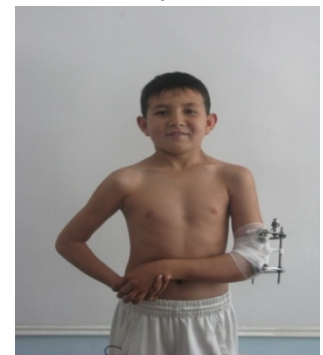
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d



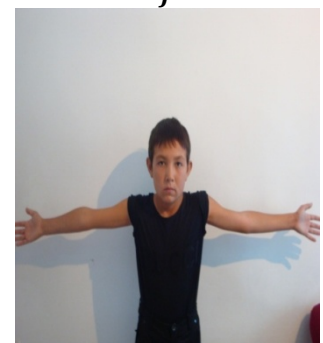
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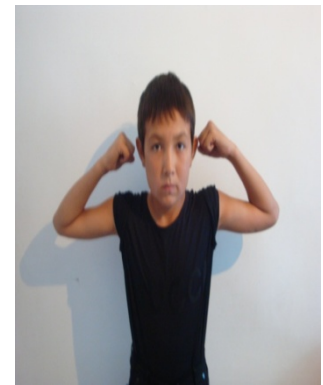
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h



i



j

Therefore, the objective assessment of the results of the treatment of children with the posttraumatic varus deformation of the elbow joint makes it possible to conclude that differential approach to selection of operative treatment method of various types of the elbow joint varus deformation should consider all components of deflection causing deformation.

CONCLUSIONS

Application of differential surgical techniques of the treatment of the children's elbow joint varus deformation depending on deformation severity can enable obtaining excellent and good results.

Developed methodology of the surgical treatment of the children's elbow joint varus deformation is the optimal one and provides good anatomic functional and cosmetic results.

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How to cite this article: Ilkhom, Khujanazarov Eshqulovich. Surgical Treatment Posttraumatic "Complicated" Cubitus Varus Of The Children. **Innovative Journal of Medical and Health Science**, [S.l.], v. 5, n. 3, p. 103-106, may. 2015. ISSN 2277-4939.

Available at: <<http://innovativejournal.in/ijmhs/index.php/ijmhs/article/view/56>>. Date accessed: 25 May. 2015. doi:10.15520/ijmhs.2015.vol5.iss3.56.103-106.