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ANALYSIS OF LONG-BONE DEFORMITY CORRECTION IN ADOLESCENTS USING OSTEOSYNTHESIS BY INTRAMEDULLARY INTERLOCKING NAILS: A PRELIMINARY REPORT

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Aims. The purpose of this study was to analyze the initial experience with adolescents treated for long-bone deformities of the lower extremities of different etiologies using osteotomies and fixation by interlocking nails.
Materials and methods. We analyzed the accuracy of long-bone deformity correction using referent lines and angles, the time of consolidation, number of complications, and functional result.
Results. We found that the accuracy of femur deformity correction (dependent on the complicity of the deformity), as estimated by different parameters, varied from 77.8% to 91.7%. Simple deformities and deformities of moderate complicity had the most accurate correction; the group of complex multiplanar deformities of the femur had the least accurate correction. This group included five cases of residual deformity, in which three of these had an angle of residual deformity <10°. The accuracy of leg deformity correction was 90%. Evaluation of the functional results using the Lower Extremity Functional Scale indicated the high functionality of the method used.
Conclusions. Correction of long-bone deformities using intramedullary osteosynthesis by interlocking nails is an effective treatment of all types of femur and lower leg deformities. When treating complex deformities of the femur, the path to operative treatment should be complex and in most cases the nailing should be accompanied by intraoperative external fixation frame assistance.

Keywords. deformity correction, intramedullary osteosynthesis, interlocking nails.

Introduction

Intramedullary osteosynthesis of long tubular bones has a vast history, and it is an integral part of traumatology and orthopedic practices worldwide. Thanks to the studies of the XVI century anthropologist Bernardino de Sahagun, it is known that Aztec tribes were familiar with intramedullary osteosynthesis. Back then, wooden sticks were used as intramedullary fixation devices [1, 2]. Later, in the XIX century, ivory replaced wooden intramedullary structures. There are even publications regarding the use of the first lockable ivory rods [1]. Additionally, intramedullary autotransplants in combination with an outer immobilizing plaster bandage were used as intramedullary fixation devices. The beginning of the XX century was marked by the appearance of steel surgical osteosynthesis hardware, including the emergence of Steinman and Rush nails [1]. The invention of the metal intramedullary nail by the German doctor Gerhard Kuntscher in the early 1940s was a revolutionary event, as this nail enabled the perfect stabilization of the fracture given the type of osteosynthesis and allowed early functional stress. However, the construction of the nail did not tolerate a certain range of loads undergone by a walking man. This defect led to torsion deformities and the formation of a large number of non-unions and false joints. In the 1970s, metal intramedullary locking nails were invented largely due to the development of the radiographic methods. Currently, metal osteosynthesis is the standard of care for long tubular bone trauma in adults [3, 4]. This technique is appropriate as it enables early ambulation with a full load on the day after the surgery. Additionally, it does not restrict movement of adjacent joints, reduces the risks of infectious and inflammatory complications, since the surgical hardware is fully covered, and maximizes the stability of the osteosynthesis [3]. Besides, intramedullary locking nail osteosynthesis is regularly used in adults for correction of long tubular bone deformity [5–9]. The combination of external fixation with intramedullary osteosynthesis is also popular. For example, with some techniques, a transosseous device is used for the correction of deformity or subsequent elongation with intramedullary locking nail osteosynthesis for final fixation [6, 10]. In infant orthopedic practice, the use of intramedullary locking nail osteosynthesis is largely restricted by the presence of functioning growth zones and by the width of the marrowy channel [6]. There are few publications describing the application of the available structures for treatment of deformities in children with comorbidities such as phosphate diabetes and fibrous dysplasia [11–13]. Besides the existing literature on shortening osteotomies using intramedullary locking nails for limb length discrepancy [14], we did not find a detailed analysis of correction accuracy of long tubular bone deformity in infants and adolescents using the reference lines and angles generally accepted in orthopedics [8, 15–17].

Study goal: To retrospectively analyze the results of surgical treatment of adolescents with lower limb long bone deformity using corrective osteotomy in combination with intramedullary locking nail osteosynthesis.

Materials and methods

The study included 26 children (11 boys and 15 girls) with lower limb long bone deformities and various congenital defects, comorbidities as well as defects resulting from trauma. The parents or guardians of all children voluntarily signed the informed content for participation in the study and for performing surgical intervention.

All patients underwent treatment between August 2014 and January 2016 in the department No.1 of the FDBI "Research Institute for Children's Orthopedics n.a. G.I. Turner." The International Classification of Diseases (ICD) was used to classify patients as shown in Table 1. The age of the majority of the studied children (21 observations) was 14–17 years; minimal age (1 observation) was 10 years.

We chose patients for the present variant of surgical treatment according to the following criteria: absence of a functioning growth zone; possibility of performing a single-step deformity correction and remedying limb-length (segment) discrepancies; the intramedullary canal width exceeding 9 mm when measured by radiographs; and absence of contractures of adjacent joints.

Deformities of the diaphyseal region were noted in 15 patients (16 segments); deformities at the metaphysis level were noted in 6 patients; and combined two-level deformities were observed in 5 patients (6 segments). In 18 limbs of 17 patients, we performed femur deformity correction. In 10 limbs of 9 patients, we performed shin bone deformity correction.

According to the practical classification of long bone deformities [18], there were 8 simple (single planar single-component) deformities (5 hip, 3 shin); 8 of medium severity (one-, two- and three-planar two- and three-component) deformities (2 hip, 5 shin); and 12 complicated (two- and three-planar multi-component) deformities (10 hip, 2 shin).

Panoramic radiographs of both lower limbs in the anterior-posterior and lateral projections were performed in all patients pre and postoperatively. The planning of deformity correction was performed according to the generally accepted algorithm [8, 16]. In the frontal plane (on anterior-posterior radiographs), the following procedures were performed: (1) building of the mechanical axis of the limb and each segment separately; (2) drawing

Table 1

Classification of patients by ICD

Diagnosis	Number of patients (operated segments)	Diagnosis	Number of patients (operated segments)
Multiple exostosis chondrodysplasia	3 (3)	Hemihypertrophy	1 (1)
Fibrous dysplasia	3 (3)	Idiopathic deformation	2 (2)
Phosphate diabetes	3 (4)	Perthes disease	1 (1)
Posttraumatic deformation	6 (6)	Blount disease	1 (1)
Lower limb congenital defect	5 (5)	Hemiparesis	1 (2)

a line for proximal and distal joints; (3) comparison of the segment proximal and distal mechanical angle values with due values; (4) determination of the deformity apex (apexes); (5) selection of the osteotomy site; (6) modelling of deformity correction using skiagrams; (7) drawing of a mechanical axis; and (8) comparison of mechanical angles with due values. For the sagittal plane, the algorithm applied was the same, except that the anatomical axis was used instead of the mechanical axis of the segment and in accordance with the fragments. The introduced algorithm of the deformity correction planning was performed using specially designed software BoneNinja (International Centre for Limb Lengthening, Baltimore, USA).

All patients underwent surgical treatment to the following extent: corrective osteotomy with intramedullary locking nail osteosynthesis. Combined external fixation and intramedullary osteosynthesis, by intraoperative deformity correction using a transosseous device and intramedullary osteosynthesis, was used in four cases. In one instance, we used successive elongation of a segment during a given period of time using the Ilizarov's apparatus with subsequent substitution with intramedullary locking nail osteosynthesis.

In five cases (three patients with phosphate diabetes and two patients with fibrous dysplasia), deformities were multisegmental and required surgical treatment of four segments: 2 femurs and 2 shins. At this stage, only one female patient from the group underwent 2 surgical treatments (osteotomy of both hip bones and intramedullary locking nail osteosynthesis). The rest of the patients underwent one surgical intervention (of 4 planned ones). Therefore, we could only assess intermediate results in these patients. Sixteen of 26 children underwent several previous surgeries on the diseased segment.

The assessment of the results was based on radiographic examinations (the deviation of the mechanical axis and the relation between the axes and the joint lines were determined). With that, the obtained results were compared with the pre-correction values and normal values. The following reference angles and lines were assessed for the femur: the mechanical lateral proximal femoral angle (MLPFA), the mechanical lateral distal femoral angle (MLDFA), the deviation of the mechanical axis (DMA), and the anatomic posterior distal femoral angle (APDFA). The following were assessed for the lower leg: the mechanical medial proximal shin bone angle (MMPSBA), the mechanical lateral distal shin bone angle (MLDSBA), DMA, and the anatomical posterior proximal shin bone angle (APPSBA). It should be noted that DMA was assessed only in the cases of single-segment deformity, that is, there was no need to correct the adjacent segment. Thus, there was a possibility of assessing the final treatment result. In the rest of the patients (five patients with multisegmental deformities), only the reference lines and the angles of the operated segment were assessed. Additionally, the union timeframes (by radiographs), the number and nature of complications, and the functional results of treatment using the Lower Extremity Functional Scale (LEFS) score were assessed.

Results and discussion

The results of the femur deformity corrections in 17 patients (18 femurs) are presented in Table 2. For example, during correction of varus deformity, the average DMA value was 3.6 ± 7.4 mm inward, and during correction of valgus deformity, 2.2 ± 4.3 mm outwards. These results correspond to the normal range. However, the DMA result exceeded normal values in 4 out of 17 cases. Therefore, deformity correction accuracy by DMA was 78%. The MLPFA values based on the results of varus deformity correction were 96.7 ± 8.1°; based on the results of valgus deformity correction, they were 77.9 ± 6.5°. These average values differ from the normal range. We associate the deviation with the fact that in five cases of complicated multicomponent deformities in patients with comorbidities such as fibrous dysplasia and phosphate diabetes, we failed to perfectly restore the interrelations in the proximal area of the femur while performing two-level osteotomies. In the remaining 13 cases (12 patients), the MLPFA correction accuracy was 92%.

The MLDFA values based on the results of varus deformity correction were 89.1 ± 4.2°; based on the results of valgus deformity correction, they were 87.5 ± 0.5°. The values corresponded with the normal range. Thus, the MLDFA varus deformity correction accuracy was 100%, and the valgus deformity correction accuracy was 84%.

The APDFA values based on the results of antecurvation deformity correction were 82.5 ± 2.3°, which corresponded with the normal range. We assessed only deformity correction results containing an antecurvation component as in our group, there were no femur deformities with recurvation. Thus, the APDFA deformity correction accuracy was 89%.

Ten limbs with femur deformity correction (9 patients) based on the classification [3] presented a complicated multicomponent multiplanar lesion. Thus, there were six cases of two-level deformity. The analysis of the correction results indicates that we obtained the normal values of all reference lines and angles only in five cases. With that, the residual deformity in four cases was valgus type. Of these, the residual varus was less than 10° in three cases; in one case, it was less than 18°. In one case, the residual deformity was varus-antecurvation type: the angle of the residual varus was 11° and the angle of the residual antecurvation was 8°. It should be noted that in all four cases, when a transosseous device was used for intraoperative correction of complicated deformity, normal values of all reference lines and angles were obtained.

In all cases of simple femur bone deformity correction (5 patients), normal values of all reference lines and angles were obtained. In one case of three medium severity deformities, an excessive 3° varus was obtained as a result of valgus deformity correction at the level of the distal metaphysis. In other cases, the correction was satisfactory.

When correcting the lower leg bone deformities in 9 patients (10 lower legs), we obtained the results shown in Table 3. Thus, by correction of the varus deformity, the average value of DMA was 2.7 ± 9.1 inwards, and by correction of valgus deformity, the average value of DMA was 1.2 ± 1.8 inwards. These results corresponded with the normal range. However, it should be noted that in two cases, DMA was outwards by 2 and 4 mm, each. The deviation data were created deliberately as in both female patients with lower leg varus deformity, the signs of arthrosis of the medial part of the knee joint were presented. In these cases, the correction goal was to “shift” the mechanical axis to the Fujisava point (lateral intercondylar ridge) [8]. The values of MMPSBA based on the results of varus deformity correction were 88.1 ± 3.6°, and based on the results of valgus deformity correction, 89.4 ± 1.5°. The average values corresponded with the normal values.

The MLDSBA values based on the results of varus deformity correction were 89.6 ± 0.9°, and based on the results of valgus deformity correction, 87.2 ± 2.7°. The values corresponded with the normal range.

The APPSBA values based on the results of antecurvation deformity correction were 81.7 ± 4.2°, and the anatomical anterior distal shin bone angle (AADSBA) values were 80.3 ± 3.5°. The values corresponded with the normal range.

The APPSBA values based on the results of recurvation deformity correction were 80.6 ± 3.8°, which corresponded with the normal range. The AADSBA values based on the results of corrections were 83.8 ± 5.8°. The fact that the number of patients with a recurvation deformity component was small (5 subjects) explains why the main value exceeded the normal range. Only in one of the five specified cases, a 7° second antecurvation deformity was obtained in the course of the lower leg deformity correction containing a recurvation component. In the rest of cases, the normal values of reference lines and angles were obtained.

Based on the analysis of the 10 lower leg deformity correction results (9 patients), it should be noted that irrespective of whether a deformity was complicated (2 cases), had medium severity (2 cases) or was a simple lesion (6 cases), the normal values of reference lines and angles were obtained in all cases with one exception (described above). Thus, the correction accuracy was 90%. However, taking into account the number of patients in the group, we consider that the presented results are preliminary and require further analysis with experience accumulation.

We were able to assess the unity time frame in 20 patients according to radiographic data. In other patients treated in 2016, time frames for unity assessment overly short. In 10 of the treated patients, signs of callus formation were visible in radiographs at 2 months postoperatively. In the other seven patients, unity was noted at 3 months postoperatively. In one case of lower limb elongation using the Ilizarov’s apparatus with subsequent intramedullary locking nail osteosynthesis, the signs of osseous reconstruction of a distraction regenerate were noted at 4 months postoperatively. In one case, after a shortening osteotomy of the shin bone, delayed union of the bone fragments was noted, for which a dynamization of the intramedullary nail was performed at 5 months postoperatively. In one case of treatment of a lower leg deformity on the background of a congenital false joint, the signs of unity were not observed at 6 months postoperatively.

In that case, further interventions will be required.

During the study period, we observed four cases of complications. Two of them were described above. In one patient with a complicated deformity of the proximal part of the femoral bone and fibrous dysplasia, despite the use of locking screws in the neck of the femur, a varus deformity of the proximal femur developed. In one case, after removal of the nail from the femur, hemarthrosis of the knee joint developed. The patient was treated according to the hemarthrosis treatment standards and this complication did not affect the treatment outcome.

It is worth mentioning that the method evaluated in the present study resulted in highly functional outcomes. For example, 24 of 26 patients were able to walk using crutches with full load on the operated limb after only 2 weeks postoperatively. Many of them, despite of our recommendations, even stopped using the crutches sooner than recommended. In 4 weeks after the surgery, all patients were able to walk without additional support. Two patients with fibrous dysplasia were not allowed to apply full load on the operated limb because of the presence of an "ill" adjacent segment. We did not meet with joint function disorders. Further, the functional results of the treatment assessed by the LEFS score at 2 weeks and 3 months postoperatively showed the great potential of the described method (Table 4).

Table 2

Reference lines on the femur deformity correction

Indicator	Normal values	Normal values	After treatment
Frontal plane			
Varus			
DMA	0–9.7 ± 6.8 mm inwards	30.3 ± 20.0 mm inwards	3.6 ± 7.4 mm inwards
MLPFA	85–95°	106.4 ± 20.6°	96.7 ± 8.1°
MLDFA	85–90°	94.5 ± 2.8°	89.1 ± 4.2°
Valgus			
DMA	0–9.7 ± 6.8 mm inwards	27.1 ± 18.1 mm outwards	2.2 ± 4.3 mm outwards
MLPFA	85–90°	76.8 ± 6.7°	77.9 ± 6.5°
MLDBA	86–92°	80.8 ± 4.3°	87.5 ± 0.5°
Sagittal plane			
APDFA	73–84°	84.3 ± 3.2°	82.5 ± 2.3°

Abbreviations: MLPFA: mechanical lateral proximal femoral angle; MLDFA: mechanical lateral distal femoral angle; DMA: deviation of mechanical axis; APDFA: anatomical posterior distal femoral angle.

Table 3

Reference lines on the lower leg deformity correction

Indicator	Normal values	Normal values	After treatment
Frontal plane			
Varus			
DMA	0-9.7 ± 6.8 mm inwards	31.7 ± 12.3 mm inwards	2.7 ± 9.1°
MMPSBA	85–90°	84 ± 1,.7°	88.1 ± 3.6°
MLDSBA	86–92°	90 ± 3.4 °	89.6 ± 0.9°
Valgus			
DMA	0–9.7 ± 6.8 mm inwards	23.8 ± 8.6 mm outwards	1.2 ± 1.8 mm inwards
MMPSBA	85–90°	94 ± 3.7°	89.4 ± 1.5°
MLDSBA	86–92°	80.5 ± 3.4°	87.2 ± 2.7°
Sagittal plane			
Antecurvation			
APPSBA	77–84°	75.5 ± 3.5°	81.7 ± 4.2°
AADSBA	78–82°	84.5 ± 6.4°	80.3 ± 3.5°
Recurvation			
APPSBA	77–84°	87.7 ± 6.3 °	80.6 ± 3.8°
AADSBA	78–82°	86 ± 3°	83.8 ± 5.8°

Abbreviations: MMPFA: mechanical medial proximal shin bone angle; MLDSBA: mechanical lateral distal femoral angle; DMA: deviation of mechanical axis; APPSBA: anatomical posterior proximal shin bone angle; AADSBA: anatomical anterior distal shin bone angle.

Table 4

Functional treatment results according to the LEFS score

Results	In 2 weeks	In 3 months
Excellent (70–80 points)	55 %	80 %
Good (51–69 points)	35 %	10 %
Satisfactory (45–50 point)	10 %	10 %

Clinical case

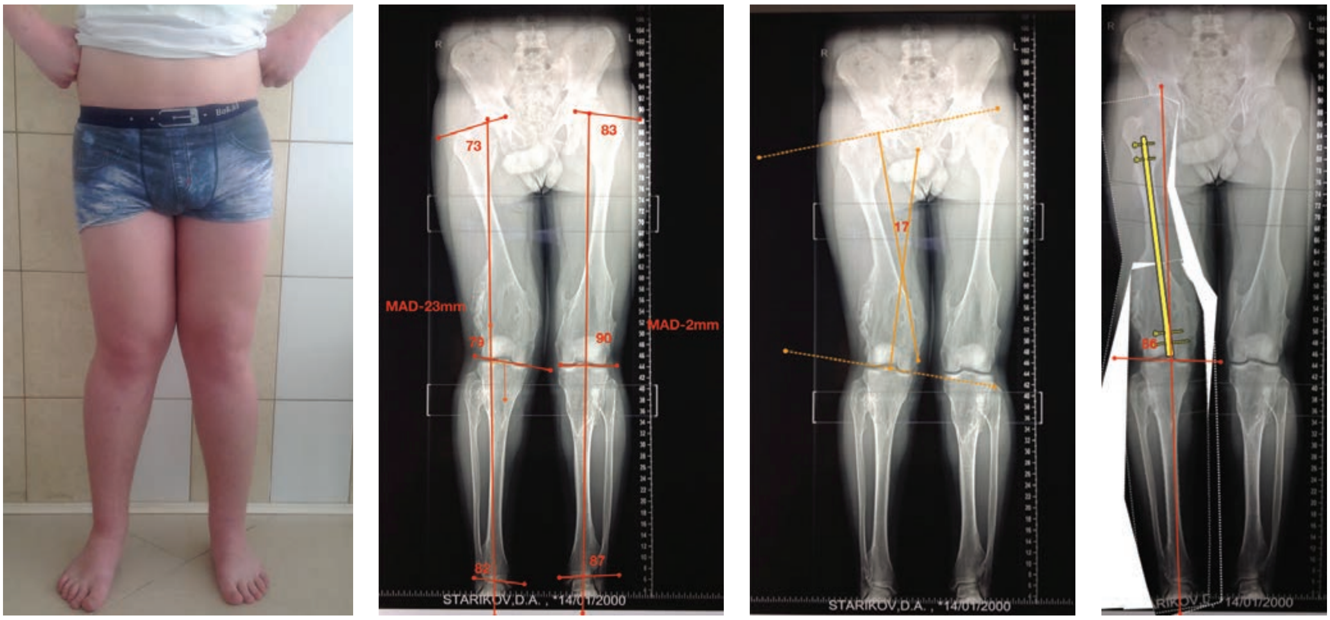
A 16-year-old male patient, S., was admitted to the clinic at the The Turner Scientific and Research Institute for Children's orthopedics with a diagnosis of multiple exostosis chondrodysplasia. On admission, the patient presented complaints on the deformity of the left lower limb. Earlier, he underwent several surgical treatments, including resection of exostoses at different locations. Additionally, forearm deformity elimination was performed using transosseous osteosynthesis. After examination and panoramic radiographic analysis (Fig. 1, *a*, *b*), the patient was found to have a valgus deformity on the medial border of the left femur with an angle of 17° affecting both the middle and lower thirds, and limb shortening by 2 cm. According to the practical deformity classification, the deformity was assessed as a medium severity deformity. Before correction, the proximal mechanical angle of the femur was 73°, the distal mechanical angle of the femur was 79°, anatomical posterior distal femur angle was 83°, and the mechanical axis deviation was 23 mm outwards. Using the software BoneNinja (International Centre for Limb Lengthening, Baltimore, USA), we planned the deformity correction by mechanical axes and skiagrams and performed a simulation of the correction and osteosynthesis (Fig. 1, *c*, *d*). We found that by using the variant of operative treatment, it was possible not only to restore the mechanical axis of the left lower limb but also to eliminate length discrepancy.

Taking into account the deformity location, the decision was taken to perform a “device-assisted” deformity correction. The principle of the method lies in mounting the modules of an external fixation device. Then, with a single-step intraoperative deformity correction, the osteotomy is performed. The correction result is assessed by radiographic evaluation. If the deformity is eliminated, a locking nail intramedullary osteosynthesis is performed, and the transosseous device is dismounted. The algorithm is used as shown in Fig. 2. Taking into account the size of the neoplasm and its close proximity to the osteotomy site, one of the exostoses of the lower third of the right femur was removed. It should be noted that the intramedullary nail was mounted in a retrograde fashion (via the intercondylar fossa of the femur), and the static scheme of the intramedullary nail fixation was chosen.

The postoperative period was uneventful and without complications. The sutures were removed on postoperative day 14. By the time of hospital discharge, the boy could ambulate without additional support (Fig. 3). The function of the lower left limb joints was fully restored. The panoramic radiographic evaluation showed the correction of the deformity: the proximal mechanical femoral angle was 81°, the distal mechanical femoral angle was 89°, the anatomical posterior distal femoral angle was 85°, and the deviation of the mechanical axis was 0 mm. The limb length discrepancy was eliminated.

Clinical case

A 15-year-old female patient, R., was admitted to the The Turner Scientific and Research Institute for Children's orthopedics with a diagnosis of congenital anomaly of the lower left limb. The condition after the left shin bone elongation in the Ilizarov's apparatus was atrophic distraction regenerate in the upper third of the lower leg, valgus-antecurvation deformity at the regenerate height, neuropathy of the left fibular nerve, equinus deformity at the level of the left ankle joint, trophic ulcer of the left foot plantar surface. The patient had previously undergone several surgeries. The last surgery was performed 4 months earlier. Osteotomy of the upper third of both bones of the left lower leg, the Ilizarov's apparatus mounting and subsequently the elongation of the left lower leg using long-term transosseous osteosynthesis were performed. Valgus-antecurvation deformity, and despite an adequate distraction pace, atrophic distraction regenerate developed (Fig. 4).



a *b* *c* *d*

Fig. 1. Patient S. before treatment: *a.* external view of the limbs; *b.* teleradiographs of the lower limbs; c. the mechanical axes of the proximal and distal bone fragments are drawn on the roentgenogram; the apex and angle of the deformity were found; *d.* a skiagram at the apex level was performed in the software program BoneNinja "simulating" the osteotomy, the deformity was eliminated, and the mounting of a intramedullary locking nail was imitated

a *b* *c*

Fig. 2. Intraoperative photographs of the patient S.: *a.* the proximal and distal supports of the transosseous device are mounted. Then, the Schanz nails were drawn in such a way to avoid hindering the drawing of the intramedullary nail; *b.* osteotomy and a single-step deformity correction were performed; *c.* the intramedullary nail was mounted

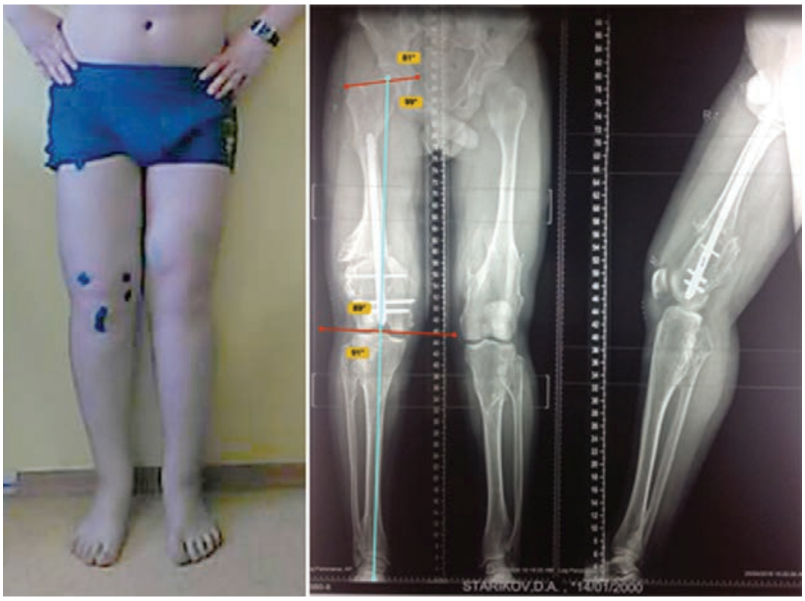
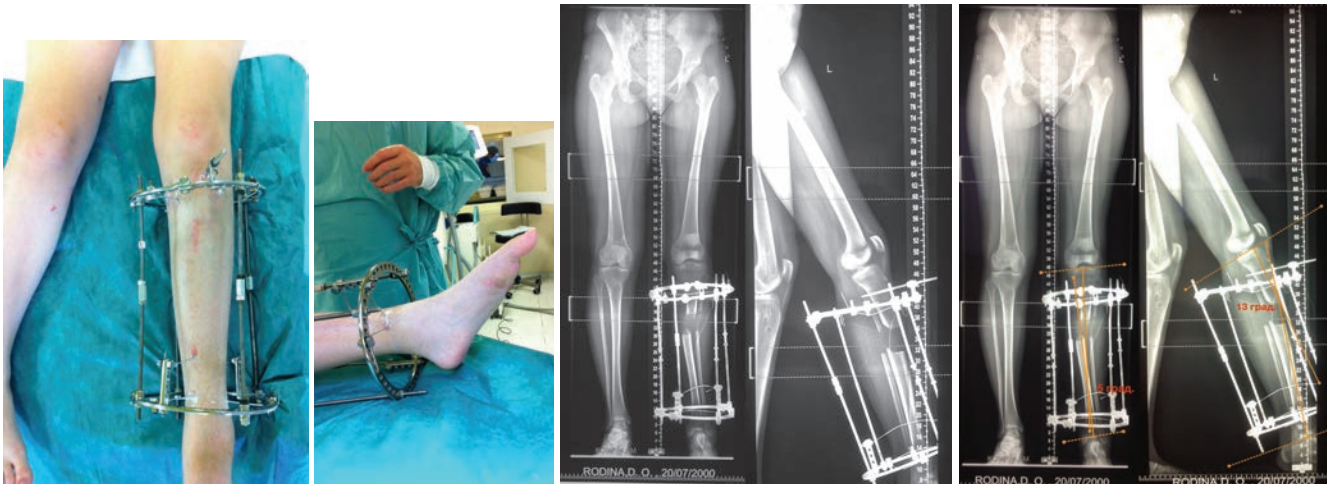
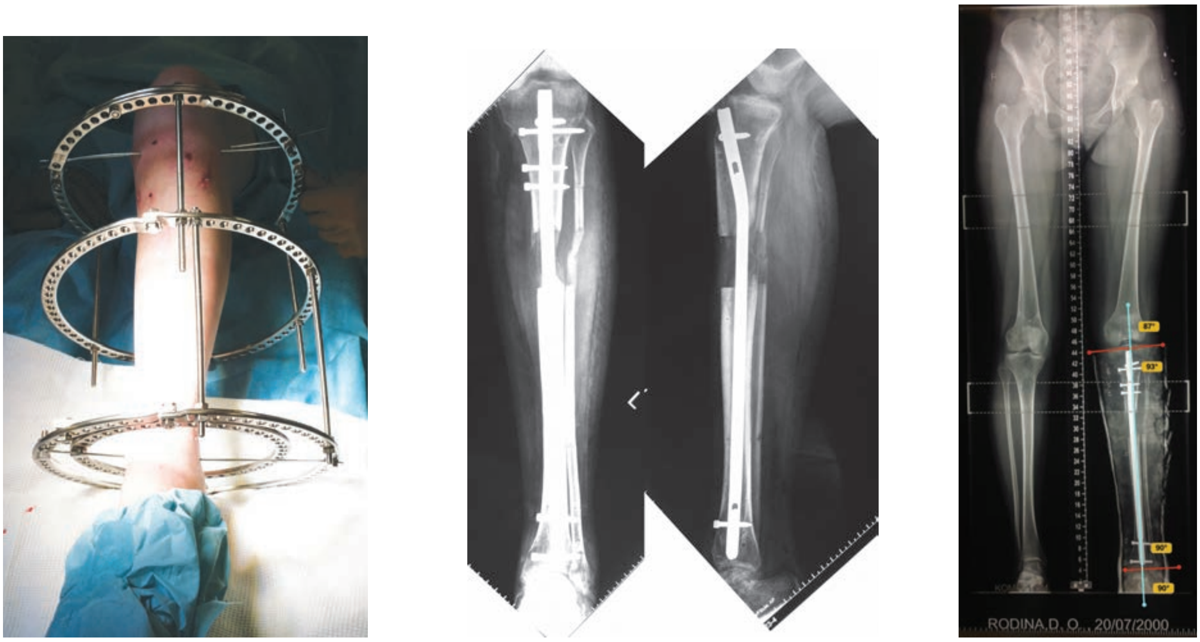


Fig. 3. Photographs and panoramic radiographs of the patient S. at 2 weeks postoperatively



a *b* *c* *d*

Fig. 4. Patient R. before treatment: *a*. external view of the lower leg before surgery; *b*. the view of the left ankle joint: equinus deformity is seen; *c*. panoramic roentgenograms of the lower limbs; *d*. in the roentgenogram the mechanical axes of the proximal and distal bone fragments are drawn, the apex and angle of the deformity are found



a *b* *c*

Fig. 5. Intraoperative photographs of the patient R.: *a*. the external fixation device was remounted to avoid hindering the intramedullary nail drawing; *b*. radiographic control after surgery; *c*. panoramic radiographs at 2 weeks after surgery

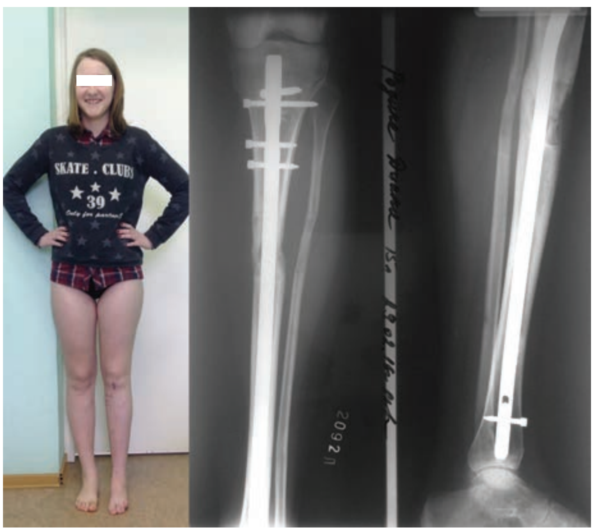


Fig. 6. Photographs and panoramic radiographs of the patient R in 4 months after surgery

The specified deformity was interpreted as a medium severity deformity. Taking into account the instability of the external fixator and the presence of deformity and distraction regenerate, we chose to perform intramedullary locking nail osteosynthesis. Before correction, the proximal mechanical shin bone angle was 84°, the distal mechanical shin bone angle was 85°, the anatomical posterior proximal shin bone angle was 73°, and the anatomical anterior distal shin bone angle was 87°.

Intraoperative remounting of the external fixation device was performed (Fig. 5, *a*). The main goals of surgery were to keep the length of the distraction regenerate, eliminate the deformity and draw the wires to avoid hindering the intramedullary nail mounting. Then, intramedullary locking nail osteosynthesis (Fig. 5, *b*, *c*) and Hoke achillotomy (drawing out the foot from equinus with plaster immobilization in a circular bandage) were performed.

The postoperative period was uneventful and without complications, the sutures were removed from the wounds on postoperative day 14. The panoramic radiographic evaluation revealed correction of the deformity: the proximal mechanical shin bone angle was 87°, the distal mechanical shin bone angle was 90°, the anatomical posterior proximal shin bone angle was 80°, and the anatomical anterior distal shin bone angle was 82°. For one month after surgery, plaster immobilization was performed in order to maintain the ankle joint in neutral position.

During the follow-up examination at 4 months postoperatively (Fig. 6), radiographic signs of bone reconstruction of the distraction regenerate were observed. Regarding the clinical outcomes, the patient can walk without lameness with a full range of motion amplitude at the left ankle joint.

Conclusion

The preliminary results of the present study indicate that the correction of long tubular bone deformities using intramedullary locking nail osteosynthesis is efficient for correction of the femur and lower leg deformities of all types. When treating complicated deformities of the femur, the approach to operative treatment should be complex and in most cases it should include intraoperative correction using a transosseous device.

Information on funding and conflict of interest

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АНАЛИЗ ЛЕЧЕНИЯ ДЕФОРМАЦИЙ ДЛИННЫХ ТРУБЧАТЫХ КОСТЕЙ У ПОДРОСТКОВ С ИСПОЛЬЗОВАНИЕМ ИНТРАМЕДУЛЛЯРНОГО ОСТЕОСИНТЕЗА СТЕРЖНЯМИ С БЛОКИРОВАНИЕМ: ПРЕДВАРИТЕЛЬНОЕ СООБЩЕНИЕ

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Цель работы: провести ретроспективный анализ первичного опыта (26 пациентов) оперативного лечения деформаций длинных костей нижних конечностей у подростков различной этиологии с использованием остеотомий в сочетании с остеосинтезом интрамедуллярным стержнем с блокированием.
Материалы и методы. Выполнена оценка точности коррекции деформаций по показателям референтных линий и углов после операции, сроков консолидации, количества осложнений и функционального результата.
Результаты. Выявлено, что точность коррекции деформаций бедра в зависимости от степени сложности деформации по разным показателям составила от 77,8 до 91,7 %. Лучшие показатели были выявлены при лечении простых деформаций и деформаций средней степени тяжести. Худшие результаты выявлены в группе сложных многоплоскостных деформаций бедренной кости: 5 случаев остаточной деформации, при этом в трех из них остаточный угол деформации составил менее 10°. При лечении деформаций голени точность коррекции составила 90 %. Оценка функциональных результатов с использованием шкалы LEFS свидетельствует о больших функциональных возможностях метода.
Заключение. Коррекция деформаций длинных трубчатых костей с использованием интрамедуллярного остеосинтеза стержнями с блокированием эффективна при лечении деформаций бедра и голени всех типов. При лечении сложных деформаций бедренной кости подход к оперативному лечению должен быть комплексным и в большинстве случаев включать интраоперационную коррекцию при помощи чрескостного аппарата.

Ключевые слова: коррекция деформации, интрамедуллярный остеосинтез, стержень с блокированием.

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