

GENU RECURVATUM AS A LATE COMPLICATION OF FEMORAL FRACTURE IN CHILDREN

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Genu recurvatum is an uncommon condition in children. Occasionally, it may occur as a late complication of femoral shaft fracture. There are studies that describe the possibility of genu recurvatum occurrence due to the tibial pin traction and without tibial tuberosity pinning. The primary traumatic reasons are Salter – Harris V-type fractures of the tibial tuberosity and tuberosity avulsion. Our case of genu recurvatum occurrence in an 8-year-old girl with femoral shaft fracture 3 years after trauma confirms the importance of this complication. We believe that the etiology of tibial physal closure and genu recurvatum after femoral fracture in children is unclear. It seems that identifying one cause for this serious complication in all cases is not possible. However, for complete elimination of iatrogenic factors, we recommend not to put the wire through tibial tuberosity in cases where traction is necessary.

Keywords: genu recurvatum, femoral fracture, skeletal traction.

ФОРМИРОВАНИЕ *GENU RECURVATUM* КАК ПОЗДНЕЕ ОСЛОЖНЕНИЕ ПЕРЕЛОМА БЕДРА У ДЕТЕЙ

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Актуальность. Несмотря на применение малоинвазивных технологий лечения, переломы длинных костей у детей могут сопровождаться развитием как ранних, так и поздних осложнений.

Цель работы: показать возможность развития *genu recurvatum* у ребенка с диафизарным переломом бедра.

Материалы и методы. Представлен клинический случай развития рекурвационной деформации коленного сустава у ребенка 8 лет через 3 года после диафизарного перелома бедра, леченного методом закрытого интрамедуллярного остеосинтеза с последующим исправлением деформации по Г.А. Илизарову.

Результаты. Проведен анализ похожих случаев, описанных в доступной медицинской литературе, рассмотрены возможные причины возникновения данного позднего осложнения.

Заключение. Этиопатогенез преждевременного закрытия передней части проксимальной зоны роста большеберцовой кости с последующим возникновением рекурвационной деформации при переломе бедра не является до конца изученным и может носить мультифакторный характер. Для исключения ятрогенного характера данного осложнения необходимо минимально использовать скелетное вытяжение за большеберцовую кость, а в случаях, когда это необходимо, проводить спицу вне зоны бугристости во избежание возможного повреждения зоны роста.

Ключевые слова: genu recurvatum, перелом бедра, скелетное вытяжение.

Introduction

Genu recurvatum is a relatively rare deformity of the lower extremities in children. The main cause for the formation of this pathology is generally the imbalance of the muscles and ligamentous apparatus in the lower extremities in children with spastic

paralysis, both primary and arising as a result of treatment manipulations. Genetically caused disorders of the formation of the bone system are achondroplasia, spondyloepiphyseal dysplasia, and arthrogryposis. According to the literature, a more rare cause of the formation of *genu recurvatum* is

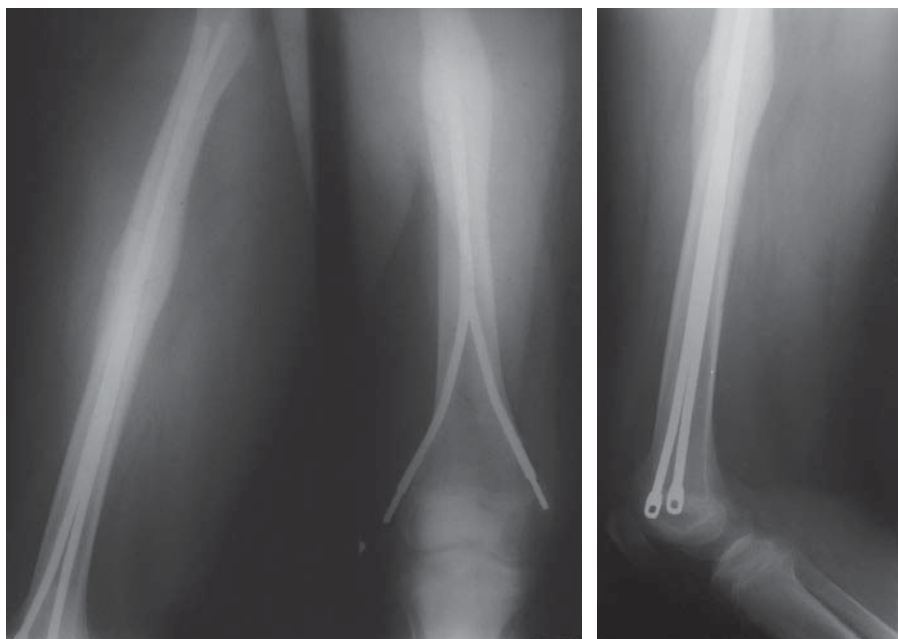


Fig. 1. Before removal of metal structures



Fig. 2. Progression of deformity after the injury (2.5 years)

the damage to the proximal zone of tibial bone growth due to trauma, which can be the direct type of Salter-Harris V damage [1] and the zone growth damage at the avulsion fracture of tibial tuberosity [2]. The formation of this deformity is described as a rare complication of Osgood-Schlatter disease [3]. In the literature, there are also references to iatrogenic lesions of the anterior part of the proximal tibial growth zone with skeletal traction over the tibial tuberosity in hip fractures, followed by the formation of *genu recurvatum* [4, 5].

Clinical observations

We have recorded our clinical observations of the *genu recurvatum* formation after a fracture of the diaphysis of the femur in an 8-year-old child (the patient's parents agreed to the publication of personal data).

A girl with trauma due to an accident developed a diaphyseal hip fracture (type A2 according to the AO/ASIF classification) and was admitted to the traumatology and orthopedic department of the clinical regional children's hospital on February 2, 2012. On admission, the patient underwent skeletal traction over the tibial tuberosity to temporarily stabilize the fracture. On day 2, the child underwent surgery; the closed intramedullary osteosynthesis of the hip with Ender's nails (ChM, Poland) was performed. The postoperative period revealed no abnormalities. The girl was discharged from the

hospital on day 18 and was verticalized on crutches with a partial load. The fracture healing occurred at the usual time. The metal structures were removed 6 months after the injury (Fig. 1).

At the time of discharge from the hospital, after the removal of metal structures, the extremity functionality was completely restored, and no axial deformities were noted. The parents of the child started to notice the formation of a knee joint deformity 1.5 years after the trauma. The child did not report any complaints during follow up visits. Over the next 2 years, a gradual progression of the deformity with the formation of *genu recurvatum* and shortening of the extremity by 2 cm was noted (Fig. 2: 2.5 years after the injury; Fig. 3: 3.5 years after the injury).

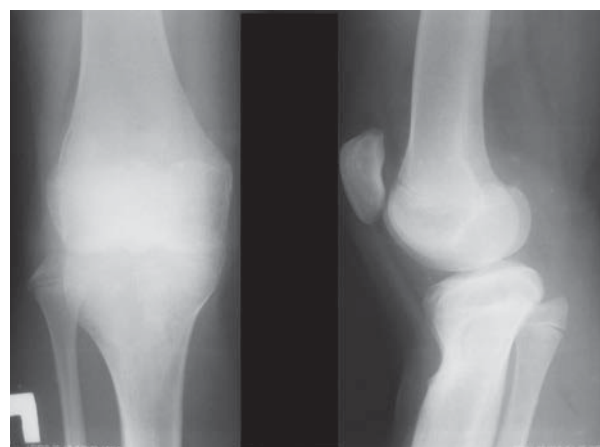


Fig. 3. Progression of deformity after the injury (3.5 years)



Fig. 4. Appearance of the extremity with a vertical load

Because of functional and cosmetic defects, a surgical correction was performed (Fig. 5, 6). The child underwent an osteotomy of the tibia in its upper third, application of a combined external



Fig. 5. Right lower leg with *genu recurvatum*



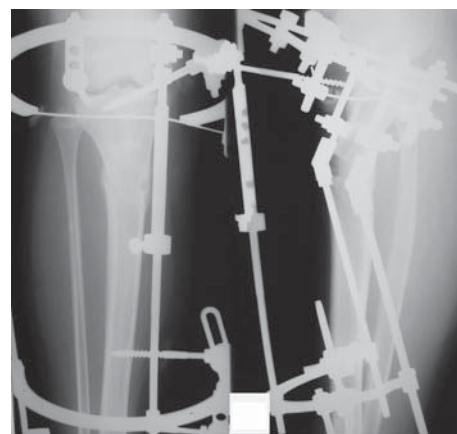
Fig. 6. Left lower leg



a



b



c

Fig. 7. Stages of correction in the external fixation device

fixation device with further correction of the axis, and shortening according to G.A. Ilizarov (Fig. 7).

The deformity was eliminated, and the device was dismantled after maturation of the regenerated bone (Fig. 8).

Discussion

The formation of *genu recurvatum* in children with hip fractures and the connection with skeletal traction over the tibial tuberosity were described by Bjerkreim and Benum in 1975 using the example of seven patients [6]. In 1980, Van Meter and Branick reported patients with a similar deformity, which was also associated with skeletal traction [5]. Unlike the first report, in this study, the authors described one patient. Available literature revealed no studies on the development of *genu recurvatum* due to pulling a needle through the skeletal traction. In a number of articles published in 1990, some authors (for example, F. Caillon, P. Rigault, J.P. Padovani, P. Jankiewicz, J. Langlais, and P. Touzet) [4] only

indicated the possibility of the development of such a complication.

In our opinion, the iatrogenic character of *genu recurvatum* development in the case of hip fracture is not obvious. Skeletal traction as a method of fracture treatment was very actively used in the middle and late 20th century, and it is also used currently as a method of temporary stabilization. Nevertheless, there are very few cases describing the development of this deformity. In 1990, A.J.R. Bowler, S.J. Mubarak, and D.R. Wenger described the observation of two patients with a hip fracture in which *genu recurvatum* was formed without pulling a needle through the tibia [7]. In one case, the needle was pulled through the femur for traction, and in the other case, an adhesive plaster traction was performed. A similar case was reported in the study by Ishikawa et al., in which the recurvation of the lower leg occurred after traction over the distal part of the femur, and direct iatrogenic damage to the growth zone was avoided. The authors feel that the damage to the proximal tibial growth zone in this case was primary and occurred at the time of injury [8]. Beslikas showed that this kind of damage (Salter-Harris V type) occurred with the formation of a typical deformity. [1] In our opinion, it is unreasonable to associate the development of *genu recurvatum* only with the pulling of the needle.



Fig. 8. Appearance of the extremity after correction and dismantling of the device

Conclusions

The etiopathogenesis of the premature closure of the anterior part of the proximal tibial growth zone with the subsequent occurrence of recurrent deformity in hip fracture is not entirely understood. Moreover, it is not possible to identify the only reason for the development of this complication in each particular case. Nevertheless, in our opinion, to minimize the possibility of iatrogenesis, the use of skeletal traction over the tibia should be restricted to a minimum extent and only when necessary (temporary stabilization, traction for reposition during surgical treatment, etc.). The needle should be pulled outside the zone of tuberosity to avoid possible damage to the growth zone.

Information on conflict of interest and financing

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