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CLINICAL CASE FOR THE USE OF INTRAMEDULLARY OSTEOSYNTHESIS IN THE TREATMENT OF PATHOLOGICAL FRACTURES OF THE FEMUR IN 6-DAY NEWBORN GIRLS WITH A HIGH PARTIAL INTESTINAL OBSTRUCTION

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Abstract. Skeletal bone fractures in newborns present a problem of modern traumatology.
Aim. The goal is to present the use of the method of intramedullary osteosynthesis in the treatment of a pathological fracture of the right femur in a newborn girl to a wide audience of pediatric orthopedic traumatologists.
Material and methods. We have experience in the treatment of a 6-day-old girl, who was born with intrauterine growth retardation and bowel disease. On the second day of stay in the intensive care unit, she had a pathological fracture of the right femur. Diagnosis of the pathological fracture was established based upon the results of clinical examination and radiography of the injured limb segment.
Results. Immediately after the diagnosis, the right lower limb of the child was fixed with a plaster bandage. On the control radiographs, the standing of the bone fragments were unsatisfactory, and a decision was made to use the intramedullary osteosynthesis method with a knitting needle on the 6th day after birth of the child. The need for surgical treatment of a fracture of the femur was due to a congenital abnormality of the intestine in the child, and a need to perform surgery on the abdominal organs.
Discussion. Spontaneous fracture of the right femur occurred in the child in treatment in the intensive care unit. The cause of the fracture was osteopenic syndrome, which developed as a result of vitamin D deficiency. During the first 12 days of her life, the newborn had two laparoscopic operations to address the intestinal pathology.
Four weeks after the operation using osteosynthesis, the metal from the bone marrow channel of the right femur was removed. After the removal of the needle, the correct axis of the operated segment was fixed to the same length of the lower extremities. The patient had absence of pathological mobility in the fracture region, and full amplitude of movements in the knee and hip joints.
Conclusion. When receiving fractures of the femur, both traditionally used conservative methods of treatment, as well as surgical methods can be used on newborn children. This is especially true, when a newborn has an accompanying congenital pathology of the internal organs requiring immediate treatment.

Keywords: newborn child, pathological fracture, femur, intramedullary osteosynthesis, intestinal obstruction.

КЛИНИЧЕСКИЙ СЛУЧАЙ ПРИМЕНЕНИЯ МЕТОДА ИНТРАМЕДУЛЛЯРНОГО ОСТЕОСИНТЕЗА В ЛЕЧЕНИИ ПАТОЛОГИЧЕСКОГО ПЕРЕЛОМА БЕДРЕННОЙ КОСТИ У 6-ДНЕВНОЙ НОВОРОЖДЕННОЙ ДЕВОЧКИ С ВЫСОКОЙ ЧАСТИЧНОЙ КИШЕЧНОЙ НЕПРОХОДИМОСТЬЮ

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Аннотация. Различные аспекты переломов костей скелета у новорожденных являются актуальной проблемой современной травматологии.
Цель — представить широкой аудитории детских травматологов-ортопедов случай применения метода интрамедуллярного остеосинтеза в лечении патологического перелома правой бедренной кости у новорожденной девочки.
Материал и методы. Располагаем опытом лечения 6-дневной девочки, родившейся с задержкой внутриутробного развития и заболеванием кишечника и на вторые сутки пребывания в отделении интенсивной терапии получившей патологический перелом правой бедренной кости. Диагноз патологического перелома установили на основании результатов клинического осмотра и рентгенографии травмированного сегмента конечности.
Результаты. Сразу после установления диагноза правая нижняя конечность ребенка была фиксирована гипсовой повязкой. На контрольных рентгенограммах стояние костных отломков расценено как неудовлетворительное, и было принято решение об использовании метода интрамедуллярного остеосинтеза с помощью спицы, который был осуществлен на 6-е сутки с момента рождения ребенка. Одним из важных аргументов в пользу необходимости оперативного лечения перелома бедренной кости оказались врожденная патология кишечника и необходимость проведения абдоминальных операций.
Обсуждение. Спонтанный перелом правой бедренной кости ребенок получил, находясь на лечении в отделении интенсивной терапии. Причиной перелома явился остеопенический синдром, развившийся вследствие дефицита витамина D. По поводу патологии кишечника в течение первых 12 дней своей жизни новорожденная перенесла две лапароскопические операции. Через четыре недели после операции остеосинтеза металлоконструкция из костномозгового канала правой бедренной кости была удалена. После удаления спицы зафиксированы правильная ось оперированного сегмента, одинаковая длина нижних конечностей, отсутствие патологической подвижности в области перелома, полная по объему амплитуда движений в коленном и тазобедренном суставах.
Заключение. При получении переломов бедренных костей новорожденными могут быть использованы не только традиционно применяемые консервативные методы лечения, но и оперативные. Особенно это актуально тогда, когда у новорожденного имеется сопутствующая врожденная патология внутренних органов, требующая незамедлительного лечения.

Ключевые слова: новорожденный ребенок, патологический перелом, бедренная кость, интрамедуллярный остеосинтез, кишечная непроходимость.

Background

The neonatal period corresponds to the time from the moment of birth to the 28th day, inclusively [1]. The probability of fractures of the skeletal bones in children of this age is extremely low [2]. However, when this does occur, the fractures are treated with conservative methods [3-5]. The Crede-Kefer [6], Pavlik [7], Blount [8], Schede [9], and plaster immobilization [10] methods are used as conservative therapy in cases of femoral fractures in newborns. We could not find publications in the literature devoted to surgical treatment methods of femoral fractures in children during the first month of life.

The **aim of the study** is to present a clinical case of intramedullary osteosynthesis for the treatment of a pathological fracture of the femur in a 6-day-old girl, to a wide audience of pediatric orthopedic traumatologists and surgeons.

Material and methods

We have experience with the dynamic observation and treatment of a 6-day-old newborn girl, K., who suffered from intrauterine growth retardation and congenital intestinal pathology. On the second day of her stay in the intensive care unit, she suffered from a spontaneous pathological fracture of the right femoral bone. The diagnosis of the pathological fracture was determined based on the results of a clinical examination and an X-ray radiography of the injured limb segment. The child's mother voluntarily signed an informed consent for processing the personal data and surgical interventions described in this article.

Results

The history of the disease development in K. is as follows. The girl was born prematurely at the gestational age of 35.5 weeks, was immature, and had intrauterine growth restriction. It was the first labor for the mother, through natural maternal passages, with cephalic presentation. The weight at birth was 1840 g and the height was 46 cm. At birth, the condition of the child was regarded as severe. The severity was due to congenital malformation

of the gastrointestinal tract (GIT) with a clinical picture of partial high intestinal obstruction. Upon agreement with the pediatric surgeon, the child was transferred from the obstetric hospital to the neonatal intensive care unit of newborns of the Budgetary Public Health Facility of the Tyumen Region, Regional Clinical Hospital No. 2, where the preparations for an abdominal surgery had started. Twenty hours after the transfer, at the age of 2 days, a deformity and pathological mobility of the right hip was found in the child during the dynamic examination by a neonatologist. X-rays of the right lower limb revealed a spiral displaced femoral bone fracture (Fig. 1, *a*). According to the intensive care unit staff, the fracture occurred spontaneously and no medical manipulations that could cause a fracture in the child were performed.

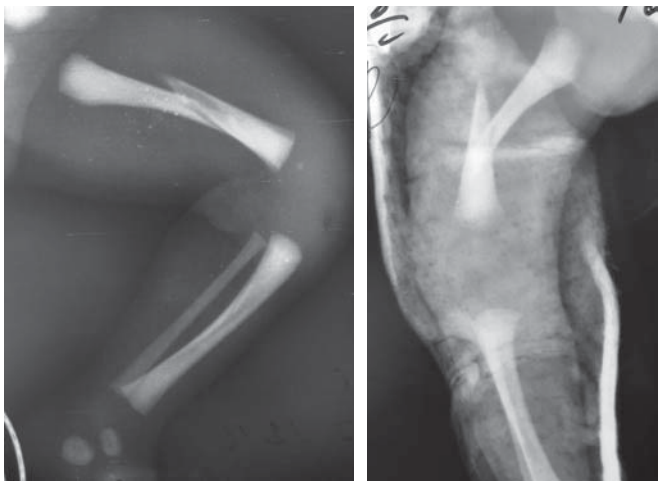
Under endotracheal anesthesia, an orthopedic traumatologist performed setting of the fracture and immobilized the right lower limb with a posterior plaster cast with a pelvic girdle. While under anesthesia, the surgeons performed laparoscopic separation of embryonic adhesions and bands, and elimination of intestinal malrotation, after which the small intestine was filled with gas, restoring gastrointestinal tract patency.

After tracheal extubation, an X-ray examination of the right lower limb was performed. On the control X-rays, the standing of the bone fragments was regarded as unsatisfactory (Fig. 1, *b*).

After surgery of the abdominal cavity, the general condition of the child improved. However, passage through the digestive tract was not completely restored and did not exclude the possibility of repeated intervention on the abdominal organs. Considering the unsatisfactory standing of the bone fragments of the right femur and the high probability of subsequent abdominal surgeries, it was decided to terminate the plaster immobilization and perform intramedullary osteosynthesis of the fracture. The purpose of the surgical treatment was restoration of the correct axis of the injured limb and reliable stabilization of the damaged bone. In addition, the creation of optimal conditions, including from the perspective of asepticism for possible repeated surgical interventions on the abdominal organs, facilitation of the resuscitation procedures, and ongoing care of the newborn in the intensive care unit were considered.

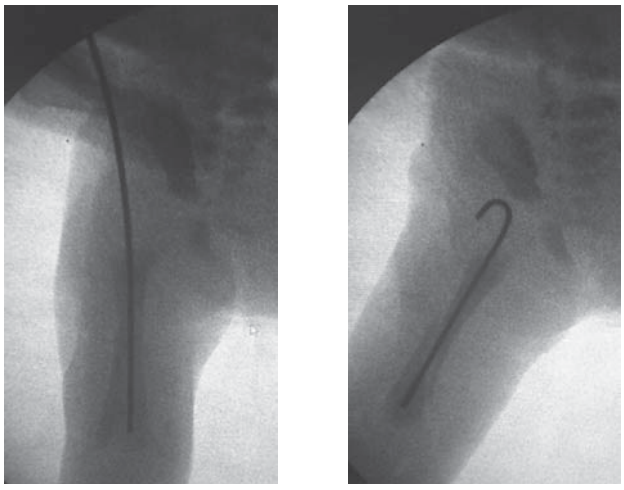
On day six after birth, the child underwent intramedullary osteosynthesis of the fracture of the right femur with a 1.5 mm diameter wire (Fig. 2).

During the preoperative preparation, it was taken into account that, as a rule, the multiplanar displacement of the distal fragment occurs with an interposition of soft tissues in the fracture line, in fractures of the femur in young children [9, 10]. Therefore, and for the purpose of preventing damage to soft tissue formations, including the femoral neurovascular bundle, the osteosynthesis was not performed strictly according to the "closed" method, but with an incision on the site of the fracture, removal of muscle interposition,



a *b*

Fig. 1. X-rays of the right femur of the newborn patient, K. A displaced spiral fracture of the femoral bone (*a*). Condition after closed manual reposition and immobilization with plaster cast (*b*)



a *b*

Fig. 2. Intramedullary osteosynthesis of the fracture of the right femoral bone. The wire was inserted antegradely into the distal fragment (*a*). The result of the osteosynthesis (*b*)

and antegrade insertion of the wire into the distal fragment under digital control of an electron-optical converter.

On day 12 after the birth, the child underwent repeat surgery due to the remaining symptoms of partial intestinal obstruction. During laparoscopic revision of the abdominal cavity, an increase in the size of the pancreatic head, which caused compression on the duodenum, was observed. The scope of surgical treatment consisted of laparoscopic duodenal anastomosis (Fig. 3).

After this surgery, the child's condition stabilized while continuing intensive therapy. She started gaining weight and by the time of discharge from the hospital, her weight was 2960 g.

There were no pathological changes in the operated limb. The lower limbs were equal in length, the femoral axis was correct, there was no pathological mobility in the fracture region, and there were neither registered restrictions of movements in the knee and hip joints, nor vascular and neurological disorders. Attention was drawn to an increase in the volume of the hip by 1.2 cm in the middle third due to periosteal callus in the fracture region. A control X-ray examination of the right femur, performed 3 weeks after the osteosynthesis, confirmed the fracture union (Fig. 4).

After another week, the wire from the medullary canal of the right femur was removed (Fig. 5)

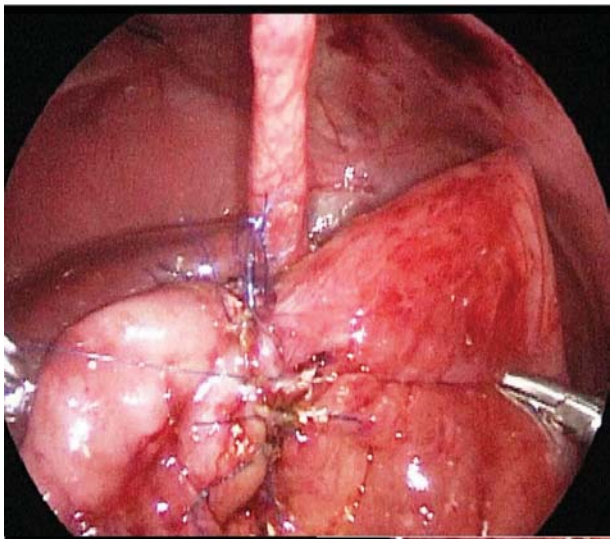
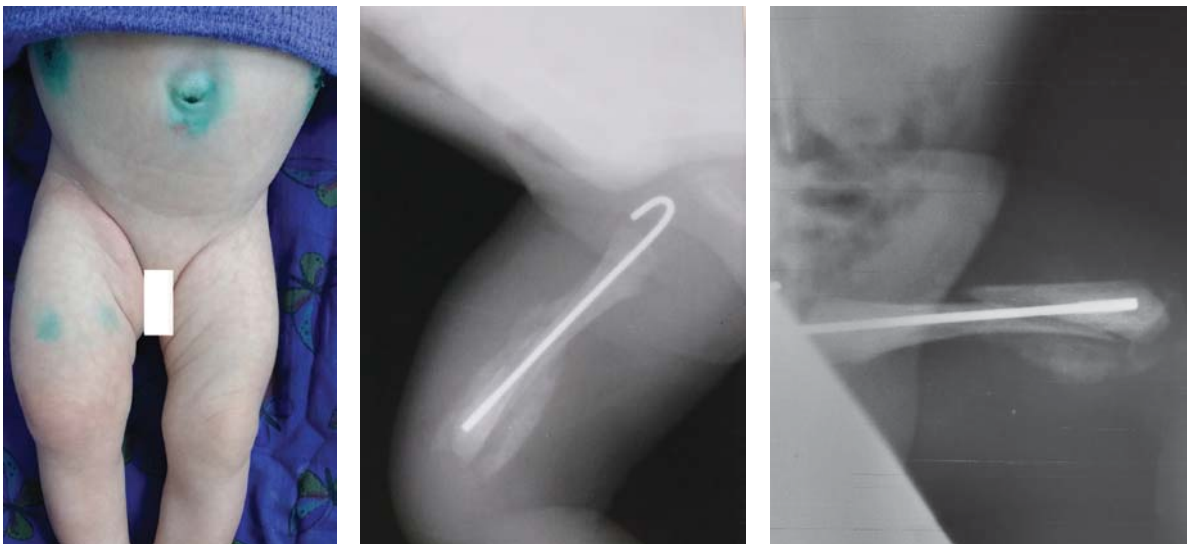


Fig. 3. Laparoscopic duodenal anastomosis

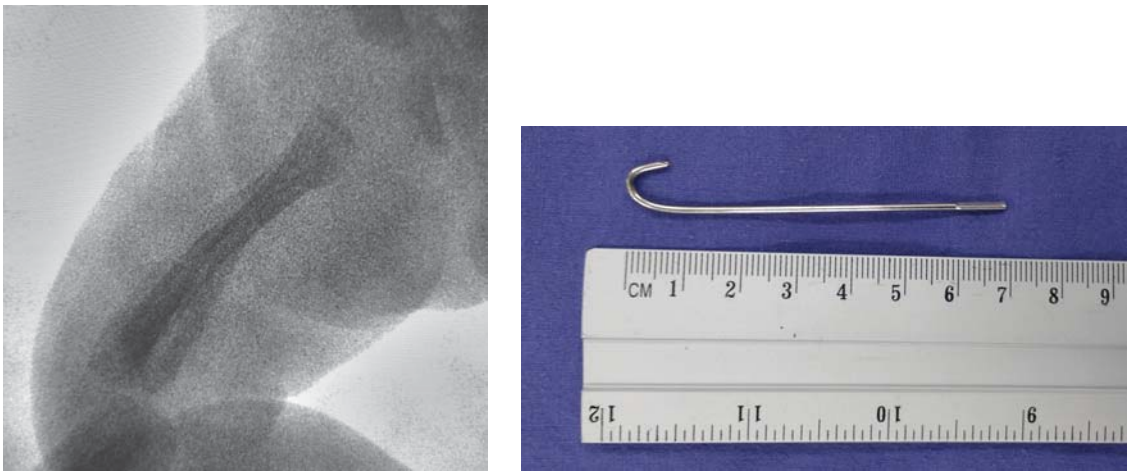
Discussion

We believe that the clinical observation of a femoral bone fracture in the newborn appeared due to vitamin D deficiency and resulted in the development of osteopenia. The biochemical blood tests for ionized calcium, phosphorus, alkaline phosphatase, and vitamin D in the child confirmed this theory. In addition to the consultations of the pediatric endocrinologist, this clinical situation was discussed by Skype communication with geneticists at the federal medical institution. The specialists concluded unanimously that the fracture of the



a *b* *c*

Fig. 4. Newborn K., 21 days. The axis of the right and left hips (*a*). X-rays of the right femur in two projections (*b, c*)



a *b*

Fig. 5. X-rays of the right femur after removal of the intramedullar wire (*a*). The wire removed (*b*)

right femur should be considered pathological due to the lack of vitamin D which caused osteopenic syndrome. The reason for the deficit could be the insufficient uptake of minerals during fetal intrauterine growth since the lack of vitamin D intake is known to be a risk factor for osteomalacia [11].

Cases of spontaneous femoral fractures in newborns treated in intensive care units, similar to the clinical observation described in this report, could be found in two literary sources. Machado et al. [12] report on causeless fractures in two newborns and Vorotyntseva et al. [13] cite one such clinical observation. According to the authors, the root cause of the femoral fractures was osteopenia. Unfortunately, nothing has been reported about the treatment methods of femoral fractures in these newborns.

The results of a large retrospective study devoted to the analysis of treatment of this type of traumatic injury conducted by P.C. Strohm et al. [14] should be considered when choosing treatment in young children. The authors studied the treatment policy in specialized clinics in Germany with respect to 756 femoral fractures in children under the age of 3 years. The frequency of conservative and surgical treatment in injured children was similar (49% and 51% of clinical observations, respectively). Thus, there is a clear tendency toward increasing the application of an active surgical approach in the provision of traumatological care to young patients with femoral fractures.

Conclusion

In some cases, such as in our clinical observation, when there is a serious concomitant congenital pathology of other organs and systems, surgical treatment of a pathological femoral fracture may be applied to a newborn child.

Information on the contribution of each author

E.G. Scriabin — participant of the concilium on the development of treatment policy and the author of the concept and design of the article; he wrote the main text of the article.

M.A. Sorokin — operating orthopedic traumatologist, who took part in surgeries of osteosynthesis and removal of surgical hardware.

M.A. Axelrov — operating surgeon, who took part in surgeries on the abdominal cavity organs and in the writing of the article.

V.A. Emelyanova — attending physician in the neonatal intensive care unit and the coordinator of the entire treatment process, who took part in writing of this article.

S.V. Naumov — participant of the concilium on the development of treatment policy, dynamic observation, and treatment of the child.

A.N. Bukseev — participant of the concilium on the development of treatment policy, dynamic observation, and treatment of the child.

A.Yu. Chuprov — participant of the concilium on the development of treatment policy, an assistant surgeon in operations of osteosynthesis of the femur and removal of surgical hardware.

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