

TREATMENT OF POST-BURN SECONDARY FOOT DEFORMITY

Afonichev K.A., Nikitin M.S., Kuptsova O.A.

The Turner Institute for Children's Orthopedics, Saint Petersburg, Russian Federation

We present a case of one-stage correction of foot deformity due to burn trauma in a 3-year-old child. Ankle joint contracture and metatarsal-phalanx joint subluxations were corrected by means of scar tissue resection, tendon lengthening, soft tissue release, and full thickness skin graft plasty. Two years after surgery, no signs of deformity recurrence were observed.

Keywords: post-burn deformities, foot, children.

At present, despite the pronounced progress in the prevention and treatment of burns during childhood, burns still remain one of the leading causes of trauma and disability in children, particularly in young children. The problems associated with surgical treatment and rehabilitation of this category of patients represent some of the most important challenges in pediatric surgery, traumatology, and combustiology [1–6]. According to recent data, more than 40% of children with burn injuries need subsequent reconstructive surgeries.

The foot is one of the most common site of localization for burns. Even after adequate surgical treatment in the acute period after thermal injury, scars that form on the dorsum of the foot often lead to subsequent deformities. The foot is composed of a large number of small joints, a subtly organized tendon-muscular system, a relatively small amount of soft tissues, and the surface location of functionally important anatomical structures. Because of these factors, damaging agents have a great impact on the foot, with the early development of secondary pathological changes, resulting in disability in childhood cases. The most severe deformities are observed in children who were injured at an early age and who did not receive orthopedic care after the healing of burn injuries. High amount of stress on a foot undergoing gradual deformation results in the development of secondary bone deformities and progression of spatial relationship abnormalities in

the joints. The long-term existence of a deformity results in the development of persistent pathological positions that are difficult to correct [3, 4].

The lack of standards for the complex treatment of burns and for the prevention of post-burn deformities of the foot result in frequent disability and serious problems with social adaptation in children. In this case report, we observed that severe complications occur, thereby resulting in developmental abnormalities and problems concerning the child's social adaptation ability; these complications are associated with the young age of the child and long period since the formation of both deformities and contractures until treatment.

Reconstructive surgery for burn deformities is associated with two major goals; the first goal is to restore the lost functions of the foot and the second goal is to improve the appearance of the patient as well as to provide psychological and social rehabilitation, which are often equally important [7–10]. Surgical rehabilitation of children with post-burn deformities remains a challenging and complicated field of surgery [11, 12].

Here, we present the case of a child with a post-burn deformity of the left lower extremity and subsequent treatment. According to the past medical history, the girl, born in 2007, was burned by hot water at the age of 1 year. She was diagnosed with heat injury of grade 2–3 on the left leg and foot. In the acute period after the injury,



Fig. 1. Image of secondary post-burn cicatricial deformity of the left foot

at a local medical facility, the child underwent skin grafting on the left leg and foot, and some wounds healed on their own. Orthosis care was not provided to the child at the time of the initial treatment.

At the age of 3 years, the child was presented to our institute's clinic with complaints of rough cicatricial deformities of the left foot and toes, pain while walking, and difficulty in choosing shoes. On admission, physical examination demonstrated that the child walked independently; however, she limped on her left leg, and the supporting ability of the left foot was reduced. Rough cicatricial deformities of the dorsum of the lower third of the left leg, ankle joint, and foot were observed. Plantar flexion of the foot was limited because of the rough deforming scars in the ankle region. The toes were deformed, shifted to the dorsum of the foot, and did not return to their anatomically correct position (Fig. 1). Subluxation was detected on performing an X-ray

examination of the metatarsophalangeal joints (1–5) (Fig. 2).

The child underwent surgery, and dissection and partial excision of the cicatricial tissue of the dorsum of the foot and the underlying cicatricial tissues were performed. To remove the toes from the dorsiflexed position and place them in their anatomically correct position, surgery was supplemented with capsulotomy of the metatarsophalangeal joints (1–5) and simultaneous lengthening of the extensor tendons of the toes (1–5). Thus, these interventions resulted in the complete elimination of the toe extension deformity. The resulting wound was closed using Wolfe graft taken from the groin area and adapted to the wound topography as well as gauze balls. The toes were fixed in the corrected position using pins (toes 1–5) and by performing subsequent plaster immobilization. Postoperatively, the child was on strict bed rest for 14 days, with the operated extremity in a raised position. On day 14,



Fig. 2. X-ray scan of secondary post-burn cicatricial deformity of the left foot



Fig. 3. Image of the operated foot 2 years after surgery

the gauze fixation of the skin graft was removed. Assessment of the skin graft revealed that complete engraftment had occurred without any signs of necrosis. The child was then allowed to walk with crutches without weight bearing on the operated extremity. The pins were removed 3 weeks after the surgery. A stage splint of the corrected toe position was performed, and the patient was permitted to walk on crutches with partial weight bearing on the operated foot. Consequently, complete and persistent correction of the deformity was achieved with no evidence of a tendency to relapse in the last 2 years (Fig. 3). Furthermore, orthosis care for the child was recommended, including wearing splints at night for 6 months, wearing customized shoes, anti-scar therapy, and rehabilitation (remedial exercises and physiotherapy).

In conclusion, the possibility of one-stage correction of severe post-burn secondary deformity of the foot was demonstrated in this case using a full-thickness skin autograft plasty.

References

1. Баиндурашвили А.Г., Калева Т.А., Афоничев К.А. Профилактика последствий ожогов у детей. // *Российский вестник детской хирургии, анестезиологии и реаниматологии*. – 2012. – № 5. – С. 25-26. [Baindurashvili AG, Kaleva TA, Afonichev KA. Preventing the effects of burns in children. *Rossiiskiy Vestnik detskoi khirurgii, anesteziologii i reanimatologii*. 2012;(5):25-26. (In Russ).]
2. Баиндурашвили А.Г., Соловьева К.С., Залетина А.В. Распространенность ожогов у детей, потребность в стационарном лечении, инвалидность. // *Российский вестник детской хирургии, анестезиологии и реаниматологии*. – 2012. – № 5. – С. 26-27. [Baindurashvili AG, Soloveva KS, Zaletina AV. Prevalence of burns in children, the need for hospitalization and disability. *Rossiiskiy Vestnik detskoi khirurgii, anesteziologii i reanimatologii*. 2012;(5):26-27. (In Russ).]
3. Афоничев К.А., Филиппова О.В., Баиндурашвили А.Г., Буклаев Д.С. Реабилитация детей с рубцовыми последствиями ожогов: особенности, ошибки, пути решения. // *Травматология и ортопедия России*. – 2010. – № 1(55). – С. 80-84. [Afonichev KA, Philippova OV, Baindurashvili AG, Buklaev DS. Rehabilitation of children with cicatricial consequences of burns: features, errors, possible solutions. *Travmatologiya i ortopediy Rossii*. 2010;1(55):80-84. (In Russ).]
4. Афоничев К.А., Филиппова О.В., Баиндурашвили А.Г., Буклаев Д.С. Послеожоговые рубцовые деформации стоп у детей: особенности клиники и лечения. // *Травматология и ортопедия России*. – 2010. – № 2(56). – С. 32-38. [Afonichev KA, Philippova OV, Baindurashvili AG, Buklaev DS. Postburn cicatricial foot deformities in children: clinical aspects and management. *Travmatologiya i ortopediy Rossii*. 2010;2(56):32-38. (In Russ).]
5. Будкевич Л.И., Петлах В.И., Пеньков Л.Ю., Буркин И.А. Опыт лечения детей с термической травмой в полевом педиатрическом госпитале. Материалы Всеармянского международного хирургического конгресса. Ереван, Республика Армения, 2003. [Budkevich LI, Petlakh VI, Pen'kov LYu, Burkin IA. Opyt lecheniya detei s termicheskoi travmoi v polevom pediatricheskom gospitale. Materialy vsearmyanskogo mezhdunarodnogo khirurgicheskogo kongressa, Erevan, Armeniya, 2003. (In Russ).]
6. Dunn KW. Standards and Strategy for Burn Care. A review of burn care in the British Isles: National Burn care Review, Committee Report. 2001. 88 p.
7. Дмитриев Г.И. Ранняя хирургическая реабилитация больных с последствиями ожогов. Материалы VII Всероссийской научно-практической конференции по проблеме термических поражений. – Челябинск, 1999. – С. 218-219. [Dmitriev GI. Rannaya khirurgicheskaya rehabilitatsiya bol'nykh s posledstviyami ozhogov. Materialy VII Vserossiiskoi nauchno-prakticheskoi konferentsii po probleme termicheskikh porazhenii. Chelyabinsk, 1999;218-219. (In Russ).]
8. Дмитриев Г.И., Жегалов В.А., Охотина Л.А. и др. Ранняя реабилитация больных с последствиями ожогов. Актуальные проблемы комбустиологии (тезисы). – Челябинск, 1996. – С. 155-157. [Dmitriev GI, Zhegalov VA, Okhotina LA i dr. Rannaya rehabilitatsiya bol'nykh s posledstviyami ozhogov. Aktual'nye problemy kombustiologii (tezisy). Chelyabinsk, 1996. S. 155-157. (In Russ).]
9. Hudson DA, Grobelaar AO. The use of tissue expansion in children with burns of the head and neck. *Burns*. 1995;21(3):209-11.
10. Арьев Т.Я. Термические поражения. – Л.: Медицина, 1966. – С. 704. [Ar'ev TYa. Termicheskie porazheniya. Saint-Petersburg: Meditsina, 1966. S. 704. (In Russ).]
11. Островский Н.В., Белянина И.Б., Якунин Г.С. Выбор сроков и методов устранения рубцовых деформаций у детей. Проблемы термической травмы у детей и подростков. – Екатеринбург, 2003. – С. 140. [Ostrovskii NV, Belyanina IB, Yakunin GS. Vybór srokov i metodov ustraneniya rubtsovykh deformatsii u detei. Problemy termicheskoi travmy u detei i podrostkov. Ekaterinburg, 2003. 140 p. (In Russ).]

12. Островский Н.В., Белянина И.Б., Куспиц Е.В. Выбор способа устранения послеожоговых рубцовых деформаций. Материалы IV конгресса по пластической, реконструктивной и эстетической хирургии. Ярославль, 8-11 июня 2003 года. – Ярославль: Р.А. «Параллакс», 2003. – С. 259-260. [Ostrovskii NV, Belyanina IB, Kuspits EV. Vybor sposoba ustraneniya posleozhogovykh rubtsovykh deformatsii. Materialy IV Kongressa po plasticheskoi, rekonstruktivnoi i esteticheskoi khirurgii. Yaroslavl', 8-11 iyunya 2003 goda. Yaroslavl': R.A. "Parallaks" 2003. P. 259-260. (In Russ).]

Information about the authors

- Afonichev Konstantin Aleksandrovich** — MD, PhD, professor, head of the department of trauma effects and rheumatoid arthritis. The Turner Scientific and Research Institute for Children's Orthopedics, Saint-Petersburg, Russian Federation. E-mail: afonichev@list.ru.
- Nikitin Maksim Sergeevich** — MD, orthopedic and trauma surgeon of the department of trauma effects and rheumatoid arthritis. The Turner Scientific and Research Institute for Children's Orthopedics.
- Kuptsova Olga Anatolevna** — MD, PhD student of the department of trauma effects and rheumatoid arthritis. The Turner Scientific and Research Institute for Children's Orthopedics.