

SURGICAL CORRECTION OF DIABETIC OSTEOARTHROPATHY DEFORMITY IN DIABETIC FOOT SYNDROME

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Objectives. To analyze the first experience of the reconstructive surgery in patients with Charcot joint.

Methods. Treatment results of 4 patients with Charcot joint (diabetic neurogenic arthropathy) who were performed the reconstructive surgery aimed to correct osteoarticular foot deformities. Charcot joint diagnostics was based on the results of clinical and radiological studies (direct radiography, computed tomography). In the treatment of patients, the technique of arthrodesis of the destructed foot joints was used with the stabilization of by the external fixators or using the techniques of focal (osteal and transosseous) osteosynthesis (internal fracture fixation).

Results. It is established that when the destruction is located in the ankle joint area, the method of choice of the surgical correction of the foot deformation in the acute phase of diabetic neurogenic arthropathy is arthrodesis of the joint with the external fixation with the compression-distraction apparatus; in the chronic phase of neurogenic arthropathy – arthrodesis of the joint using internal fracture fixation with a metal plate with angular stability of screws. When the destruction zone is located in the middle part of the foot in the chronic phase of the disease, the method of choice of the surgical correction is arthrodesis of the tarsal joints with the internal fixation with the metal wires. In all 4 patients, the performed surgical interventions resulted in the improvement of the anatomical and functional characteristics of the foot and there was no need to use complex orthopedic footwear while resting on the limb and walking, and one managed to avoid recurrences of trophic ulcers on the foot during the entire period of the postoperative follow-up.

Conclusions. The issue of using various methods of orthopedic correction of the foot deformity is relevant in the surgery of the diabetic foot syndrome (DFS) and should be considered individually, taking into account such factors as: the stage of the disease, localization and prevalence of the bone-joint destruction zone, the severity of foot deformity, the presence of foci of purulent inflammation and trophic ulcers as well as the patient's somatic status.

Keywords.

diabetic foot syndrome, Charcot joint, neurogenic arthropathy, foot deformity, arthrodesis of the joints, foot trophic ulcer.

Introduction.

The treatment of diabetes mellitus (DM) and its complications remains an urgent direction of modern medicine [1,10]. In the Republic of Uzbekistan, there is an annual increase in the incidence of diabetes by 3-6%, while every 12-15 years the number of patients with diabetes doubles [2]. The progression of DM is accompanied by the development of a number of severe complications, one of which is diabetic foot syndrome (DFS) [3,8]. A rare but severe form of SDS is diabetic neuroosteoarthropathy (DNOAP) or Charcot's foot [1, 4]. In the international agreement on diabetic foot of 1999, DNOAP is defined as non-infectious destruction of bones and joints of the feet associated with diabetic neuropathy [5,9]. The prevalence of DNOAP among patients suffering from DM ranges from 0.1 to 7.5% [6]. DNOAP in 29% of cases complicates the course of diabetic polyneuropathy of the lower extremities [6,15]. Pronounced deformity of the foot with a violation of its static-dynamic properties is a natural outcome of DNOAP, leading in 60-70% of cases to the formation of extensive ulcerative defects, the development of purulent-necrotic lesions of the soft tissues of the foot and osteomyelitis, which ultimately determines the high frequency of amputations in the structure of patients with DNOAP and the mortality rate reaching 30-35% [1,4,11]. Currently, the problem of using surgical methods to stabilize bone structures and correct foot deformity is relevant both against the background of the ongoing process of osteolysis in the acute phase of the disease, and during the formation of persistent anatomical and functional changes of the foot in the chronic phase of DNOAP [7,14].

Objectives. To analyze the experience of using the first reconstructive and reconstructive surgical interventions in patients with Charcot osteoarthropathy.

Material and methods

The case histories of 4 patients with Charcot osteoarthropathy who were treated in the department of purulent surgery and surgical complications of diabetes mellitus at the multidisciplinary clinic of the Tashkent Medical Academy in 2020-2022, who underwent reconstructive and reconstructive surgical interventions aimed at correcting foot deformity in DNOAP, were analyzed. Data on patients are given in the table. Diagnosis of Charcot osteoarthropathy was based on the results of clinical and radiological studies. Differential diagnosis between osteoarthropathy and osteomyelitis to resolve the issue of the method and scope of

surgical intervention was carried out using histological examination of bone tissue samples from the area of bone and joint destruction. In the treatment of patients, the technique of arthrodesis of the destroyed joints of the foot was used with the performance of osteosynthesis by an external fixation device, or using techniques of focal osteosynthesis. The results of treatment of patients were evaluated in the time interval from 4 to 12 months from the moment of surgical intervention. The criteria for evaluating the treatment were the consistency of the performed arthrodesis, confirmed by X-ray examination data, the absence of recurrence of trophic ulcers on the feet, as well as the restoration of the lower limb support function.

Results

It can be seen from the table that three patients had type IV lesions according to the Sanders classification involving the ankle and hip joints in the pathological process, one of these three patients had an acute phase of DNOAP, two had chronic (Fig. 1).

Table

Data on patients with DNOAP who underwent surgical interventions to correct foot deformity

Patient	Age (years)	Paul	Type of SD	Duration of SD (years)	Duration of DNOAP(years)	DNOAP phase	Localization of the destruction zone (by Sanders)
1	56	M	2	15	1	acute	IV
2	40	F	1	10	6	chronic	IV
3	35	F	1	12	5	chronic	III
4	60	M	2	8	3	chronic	IV

One of the four patients had a type III lesion according to the Sanders classification with localization of the bone-joint destruction zone in the middle part of the foot (Fig. 2). Indications for surgical treatment: - the development of severe foot deformity in three patients with type IV Sanders lesion, not corrected by orthopedic means, accompanied by a pronounced violation of the lower limb supportability- the development of recurrent trophic ulcers in one patient with a lesion of the middle part of the foot (type III lesion according to Sanders) against the background of pronounced deformity of the foot, not corrected by orthopedic devices.

Fig. 1. Type of feet and radiographs of feet of patients with type IV localization of the destruction zone (according to Sanders): A, D - patient No. 4,

60 years old; B, D – patient No. 2, 40 years old; C, W – patient No. 1, 56 years old (arrows indicate the destruction zone).



Characteristics of performed surgical interventions. Corrective arthrodesis of the ankle joint with screws and spokes was performed in two patients with type IV localization of the lesion against the background of the chronic phase of DNOAP. However, in one of these patients 4 months after the operation, in the other – 1 month later, the failure of arthrodesis was established, which required repeated surgical intervention. In both cases, a rearthrodesis was performed with an internal fixation plate with angular stability and screws, which made it possible to achieve stability of the ankle joint (Fig. 3). In the postoperative period, patients underwent immobilization of the lower limb with a circular plaster cast for a period of 12 weeks.



Fig. 2. Patient No. 3, 35 years old, type III localization of the destruction zone (according to Sanders): A - type of foot (arrows indicate trophic ulcers of the plantar surface of the foot); B - radiograph of the left foot, oblique projection (curly bracket indicates the destruction zone)

In patient No. 1, 56 years old, with type IV localization of the destruction zone against the background of the acute phase of DNOAP, arthrodesis of the ankle joint was performed with external fixation by Ilizarov compression-distraction apparatus and corrective osteotomy of the left calcaneus and tarsal bones (Fig. 4). During treatment, this patient managed to achieve a satisfactory comparison of bones in the zone arthrodesis with preservation of the lower limb supportability.



Fig. 3. Patient No. 4, 60 years old, condition after surgical treatment: A - X-ray of the right ankle joint, direct projection, arthrodesis with a metal plate and screws; B - type of foot, 14 days after surgery.

Patient No. 3, 35 years old, with type III localization of the destruction zone according to the Sanders classification, corrective arthrodesis of the foot was performed using bone autoplasty, internal fixation with metal spokes with

simultaneous plasty of the Achilles tendon and excision of a trophic ulcer of the plantar surface of the foot. The results of the change in the anatomy of the foot skeleton achieved as a result of the performed intervention are shown in Figure 5. In the postoperative period, the patient underwent immobilization of the limb with a posterior plaster splint for 3 months. In all four patients, arthrodesis remains stable for 4-12 months after surgical treatment, no recurrence of trophic ulcers on the feet was detected, and the lower limb supportability was preserved.

Fig. 4. Patient No. 1, 56 years old, condition after surgical treatment: A, B - view of the left foot and X-ray of the left ankle joint, 8 weeks after surgery, external fixation by Ilizarov apparatus.



Discussion

Currently, no clear approaches have been developed to determine the indications for surgical treatment of foot deformities in DNOAP, there are no recommendations regarding optimal methods of correction of deformity and stabilization of anatomical structures of the foot, in addition, the experience of using such interventions in domestic clinics is small. It is known that in the acute phase of Charcot osteoarthropathy, the goal of treatment is to suspend the process of destruction of bone tissue, which is achieved by immobilization of the lower limb on the side of the lesion for a period of 3 to 6 months. The optimal condition for performing surgical interventions aimed at correcting the resulting deformity of the foot is the transition of the process to the chronic phase. The purpose of such interventions is to maximize the restoration of the anatomical and biomechanical characteristics of the foot necessary to perform the function of support and walking. Surgical treatment in the acute phase of the disease, according to most authors, is impractical due to the high risk of progression of the processes of bone

and joint destruction. However, in cases where it is not possible to eliminate the instability of the destroyed joint with the help of immobilization of the limb, the question of performing surgical intervention becomes open. This situation may arise in cases of severe deformity of the foot with a pronounced violation of the limb's ability to support (especially with the defeat of the ankle joint), with progressive bone-joint destruction, which cannot be stopped by adequately performed immobilization of the limb, as well as when trophic disorders occur on the foot due to its pronounced deformation. One of the above-described patients (No. 1) had an acute phase of DNOAP with a lesion of the ankle joint. Conservative treatment for 12 months did not allow the suspension of the process of bone and joint destruction, which ultimately led to the total destruction of the ankle joint and loss of the ability to support the left lower limb. In addition, the patient repeatedly underwent inpatient treatment for purulent lesions of the soft tissues of the foot during the specified period of time, which occurs as a complication of recurrent trophic ulcers of the foot.

In both cases, during repeated interventions for osteosynthesis, we successfully used a metal plate with angular stability, which was placed on the medial surface of the tibia and calcaneus. The instability of the middle part of the foot, which was present in patient No. 3, led to the development of a deformity of the "rocking foot" type, which caused the inevitable occurrence of long-term non-healing and recurrent ulcerative defects on the plantar surface of the foot. In this case, Ilizarov spokes were used for arthrodesis of the tarsal joints, and in order to avoid shortening of the foot, bone autoplasty was additionally performed, in addition, Achilles tendon plastic surgery and excision of an ulcerative defect of the plantar surface of the foot were performed. All this eventually made it possible to improve the anatomical and functional characteristics of the foot, to abandon the use of complex orthopedic shoes and to avoid relapses of trophic ulcers on the plantar surface of the foot in this patient during 12 months of observation from the moment of the operation.

Conclusions

Charcot's osteoarthropathy is a severe complication of diabetes mellitus, accompanied by massive destruction of the bone and joint structures of the foot, leading to the loss of its anatomical and functional properties. When choosing a technique for surgical treatment of foot deformity in DNOAP, it is necessary to take into account factors such as the stage of the disease, localization and prevalence of the destruction zone, the presence of foci of purulent inflammation and trophic

ulcers, the somatic status of the patient. The question of the use of certain methods of orthopedic correction of foot deformity remains relevant in SDS surgery and should be considered individually, taking into account the factors listed above.

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