
The Analysis of Treatment of Thromboangiitis Obliterans by the Technology of the Bone Transport Microcirculation Reconstruction

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Abstract: [Objective] Explore the effectiveness and practicability of the lateral tibia bone transport technology for the treatment of thromboangiitis obliterans of lower limbs [Methods] 52 patients with thromboangiitis obliterans by lateral tibia bone transport operation. On the fifth day after the surgery, the tibial bone mass was transversely transported under the action of external stent, after carry out for 21mm, hold for 3 days, carry back again, finish the bone transport in 50 days after surgery, then the external stents were removed, and then evaluate the effectiveness by angiography, limbs survived and follow-up [Results] 45 of 52 cases obtained satisfactory curative effect, limb ischemia necrosis were completely improved. through 2 ~ 3 years follow-up time. There are still severe lower limb ischemia necrosis cases, 7 cases of postoperative lower limb amputation. The total effective rate was 87%. [Conclusion] Lateral tibia bone handling technology can be effective treatment of thromboangiitis obliterans of lower limbs, the surgical operation is simple, safe and effective, the method is worthy of clinical promotion.

Keywords: Tibia Bone, Transport, Thromboangiitis Obliterans

1. Introduction

Thromboangiitis obliterans (TAO), also known as Buerger disease, is an inflammatory, segmental and recurrent chronic occlusive disease of blood vessels. Multiple attacks on the limbs, small arterial veins, with the lower limbs to see more, more in the male. According to Cooper LT, Tse, et al., among 111 patients, TAO has a 5-year amputation rate of 25%, a 10-year amputation rate of 38%, and a 20-year amputation rate of 46% [1]. Treating TAO, vascular surgery and medicine conservative treatment had no obvious curative effect, our hospital since 2012 to carry out the limb-salvage surgery lateral tibia bone handling treatment of thromboangiitis obliterans, curative effect is satisfactory.

2. Materials and Methods

2.1. General Information

From January 2012 to November 2014, 52 patients were treated in our hospital for the treatment of thromboangiitis obliterans of lower extremities, including 8 cases with history of diabetes and 48 cases with long-term smoking history. 52 cases patients in different levels of intermittent claudication, 50 cases with resting at night pain, reduce plantar skin temperature (plantar skin temperature is 26 ~ 29°C, An average of 28.2°C), toes and foot dorsum skin color red sauce, 48 cases of plantar ulcer with infection, 12 cases gangrene, preoperative colour to exceed and artery angiography showed that shallow artery occlusion 15 cases, 20 cases of popliteal artery occlusion, 12 cases of posterior tibial artery occlusion, pretibial artery occlusion in 5 cases, 52 cases, 46 cases show difference of dorsalis pedis artery blood supply net, 6 cases of dorsalis pedis artery network development is not clear.

2.2. Preoperative Preparation

8 patients with diabetes mellitus were treated with insulin before operation, and the blood glucose control standard was no more than 7 mmol/L before meal and < 11.1 mmol/L after the meal. All 48 patients with smoking history were required to quit after 3 days.

2.3. Treatment

52 cases patients with lateral tibia bone transport operation, all operations are completed by the same doctor, surgery with continuous epidural anesthesia, after anesthesia in patients with good, to select middle 1/3 of the medial tibia bone transport area, about 10 cm x 2 cm bone transport plane area, longitudinal shape cut three between bone handling area director of about 1.5 cm, skin incision, every skin incision long interval of 2 cm of normal skin, from above the skin incision open, first in minimally invasive drilling locating rod, electric drill, drilling displacement of locating rod order, from top to bottom in turn around punching, after the perforation is completed, two points of bone transport are selected as bone moving needle to be inserted into the position, drilled and twisted into the bone moving needle; Slight separation can be achieved with treatment of movable tibia bone flap, be careful not to damage the bone marrow, marrow cavity adjustment and fixation tibial external fixation handling frame and screw into the external fixation nail. Suture the subcutaneous tissue and skin, wound dressing and dressing. If there is a foot ulcer and infection, the debridement or VSD negative pressure of the foot can attract treatment. About gangrene of the toe, the operation is remove the necrotic part.

2.4. Postoperative Treatment

Postoperative use of low molecular heparin sodium anticoagulation in the 10 days, review of the X-ray after the operation, sideways moving tibia bone block in the fifth day, a day to move 1 mm, outside points three times to complete, after 21 days [2] the tibia bone block move 21 mm, maintain 3 days then move back 1 mm every day, points three times to complete, and 21 days after the end of shift. After 3 weeks of fixation, reexamination of lower extremity angiography and X-ray plates, and the removal of external fixator after the bone was healed. After treatment, the needle was wound with iodide gauze to prevent infection, and it was treated with medicine, debridement or skin grafting for infection and ulcer wound.

2.5. Index of Observation

The main observation indexes were ulcer healing and angiography observation of microvascular regeneration.

3. Results

All the patients had a smooth operation, and 45 of the 52 cases were successful in microangiogenesis, and the ulcer and infection wound healing was good, with an effective rate of

87%. 7 cases of failure, all 5-7 days after surgery operative incision of calf skin leather black edge necrosis, no improvement distal limb ischemia symptoms and progression, two weeks after invalid conservative treatment, 3 of whom below the knee amputation, 2 above knee amputation, 2 Double amputation (after below the knee amputation, the wound is not healed, infected, and the effect of dressing and debridement is not good enough, then above knee amputation). All patients were followed up for 1~2 years.

4. The Postoperative Conditions of 45 Patients with Effectivity

4.1. Pain Relief

28 cases of 45 patients resting on postoperative day 1 began to ease pain, 17 cases underwent 3 days began to gradually ease, to the end of the treatment, 38 cases of patients with pain all did not appear again, 7 patients fell pain when temperature changes Once in a while.

4.2. Skin Color and Skin Temperature Improvement

Toes and foot dorsum skin color in postoperative 1 week began gradually from the sauce red to reddish, plantar skin temperature in the postoperative 8-10 days began to rise gradually, 4 weeks after skin temperature is 28.5 ~ 32.5°C, the average is 30.8°C.

4.3. Ulcer Healing and Infection Status

30 cases of plantar ulcer with postoperative infection in patients with foot ulcers were healed, move 1 weeks after wound began to dry, necrotic tissue decreased, 3 weeks later you can see the wound dry crust healing gradually.

4.4. Vascular Restoration

50 days after the operation, angiography revealed a large number of small arteries in the distal limbs and feet, interwoven into a net, and extended extensively.

4.5. Surgical Complications

1 case of pulmonary embolism occurred 1 week after operation and transferred to ICU for treatment. Three cases were infected with external fixation nail tract infection, and the treatment was cured after 1-2 weeks, one patient found deep venous thrombosis of lower extremity, and improved after antithrombotic therapy.

4.6. Limb Function

All patients can regain normal muscle tension after healing of ulcer, and can walk independently without the aid of crutches and other tools.

4.7. Follow-up Status

All patients were required to give up smoking, orally danshen tablets, of which 42 patients had no recurrence, and 3

patients relapsed six months after surgery, and the tibial bone remover was treated with good effect.

5. Typical Cases

A patient, male, 42 years old, left foot toe black discharging 6 + months, physical examination: the left foot toe black necrosis, toe falls off from the bottom, deep tendon tissue necrosis, plantar form a larger pus cavity, a large number of purulent secretion, left foot resting sex companion claudication, pain, unable to sleep at night, the left foot skin temperature is low. Preoperative angiography showed that the posterior tibial artery was partially blocked, the dorsal foot and toe blood vessels were poorly distributed. Patients without diabetes and hypertension, without a clear history of trauma, there is no absolute contraindications to surgery. The left side of the lateral tibia bone transport + resection of the left foot toe and debridement surgery through epidural anesthesia, intraoperative cannot issue suture of the wound. Postoperative day 1 left foot resting the pain began to ease, patients can fall asleep, after the fifth day bone carrying, every 1 mm, divided into three times, after 10 days the skin temperature began to rise gradually, gradually wound dry, patients can walk. In the 50th day after the surgery, the angiography showed that the dorsal foot and toe were more small arteries, and were interwoven into a net. After the basic healing of the lumbar, the external fixator was removed and the patient could walk independently. The wound was healed completely after the wound was changed, followed for 1 year, and no necrosis was found in the original wound and its residual toe. (Figure 1)



(a)



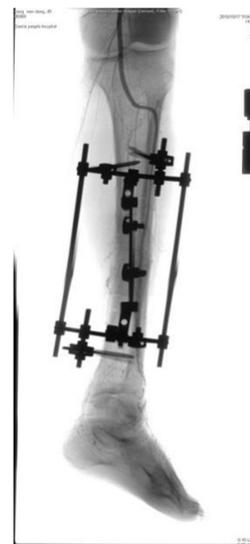
(b)



(c)



(d)



(e)



(f)



(g)

Figure 1. (a): preoperative limb angiography of posterior tibial artery embolism, less foot artery.(b-c): preoperative at general view (d): Limb wound case after 2 weeks (e): 50 days after limb angiography foot form extensive arterial network.(f): 70 days after dismantling and limb wounds of outside support.(g): after 2 + months the original wound healed completely, the remaining digits with no necrosis.

6. Literature Review

At present, for the treatment of thromboangiitis obliterans, The commonly used vasodilators for conservative treatment include PGI₂, 5-HT₂ receptor antagonists, and angioendothelin-1 receptor antagonists, which can partially relieve symptoms such as ischemic pain [3, 4] surgical treatment is mainly amputation. But in recent years with the development of interventional techniques and materials, percutaneous endovascular angioplasty (PTA) become the treatment of choice for knee artery occlusion, but according to reports in the literature, knee artery PTA restenosis is to 50% after 6 months through operation [5], the long-term patency rate is low. Kilickesmez O et al [6] reported that a Rotarex thrombectomy device used balloon dilation forming to perform thrombectomy of pathological segment in a TAO patient who was involved in the femoral popliteal artery, so as to achieve limb vascular recanalization. However, the practice shows that the balloon dilatation combined with mechanical thrombectomy can achieve targeted volume reduction of diseased vessels and immediate recanalization of diseased vessels. However, physical opening of diseased vessels was only performed, and the sympathetic nerve existing in the outer membrane of vessels was not treated, which also caused the re-stenosis or occlusion of diseased vessels in TAO. It was reported that the intracavitary radiofrequency ablation to treat TAO, such as Tang, J [7] 30 cases of patients with TAO RFA, the success rate of 100%, immediate postoperative DSA imaging in femoral artery occlusion, 2 years of follow-up, no recurrence, 1 line for continued smoking amputation surgery, postoperative pain score was significantly decreased ($P < 0.001$), after two weeks, two years of ABI values were significantly higher than

that of preoperative ($P < 0.001$), the curative effect, but the technology is reported to domestic success rate is low. Overseas reports on the treatment of TAO, Ra JC et al. [8] reported 17 cases of TAO treated by intramuscular injection of mesenchymal stem cells derived from autologous adipose tissue (5 million/kg). Wan J et al. [9] reported that 64 cases of TAO (80 limbs) received peripheral blood stem cell transplantation, 5 cases of high level amputation, and 59 cases (75 limbs) were successfully operated. Angiography of the arteries was found in 6 months after the operation. However, this technology is still in the initial exploration, and the technical requirements are high, which can not be widely used in clinical practice.

Principle of tension stress are members of the Russian medical Ilizarov founded in the 1960 s reconstruction theory, after a lot of practice to prove: biological tissue is slow, continuous tension produces a certain amount of stress, can stimulate the regeneration of the body. For instance, nearly 10 years, we use the lower limbs bone transport technology to the treatment of a large number of bone defects after open damage or after bone resection, through the normal bone slow continuous traction, and generate a new bone tissue of fracture end, eventually achieve the bone healed completely. Since a large number of clinical practice prove that by bone transport can generate new bone tissue, then by bone transport whether can stimulate new vascular tissue regeneration, foreign Jagdish Jashw antlal Patwa [10] use this bone transport technology was applied to 60 patients with TAO, and two to 11 years of follow-up, achieve good curative effect. Domestic many experts use the tibia bone transport technical treatment of diabetic foot to achieve good results, they found that through to the tibia bone block slow continuous traction can make cell proliferation and biosynthesis were stimulated, the bone and muscle and fascia adhesion, blood vessels and nerves of synchronous growth [11].

7. Conclusion

Diabetic foot is foot ischemic necrosis caused by vascular microcirculation disorder, through the tibia bone transport stimulated the foot the growth of new blood vessels, rebuild the foot the microcirculation of the blood supply, eventually achieve the healing of wounds. Buerger's disease is also same foot ischemic diseases, we through the tibia bone transport technology treatment of 52 patients with buerger's disease combined with anticoagulant medication at the same time, the effect of 45 cases of postoperative angiography showed transport bone around and foot formed rich new microvasculature, effectively rebuilt the microcirculation of ischemic tissues.

In 7 cases of failure analysis, the average history was longer (> six months), the skin color was red to the lower leg, and the skin temperature was lower than the knee joint. Angiography showed 5 cases of popliteal embolization, 2 cases of posterior tibial artery embolism. The main vessel wall was damaged, and the microcirculation was seriously obstructed. There was no hope of regeneration of microvessels.

Lateral tibia bone transport microcirculation reconstruction technology of thromboangiitis obliterans with good clinical

curative effect, and the operation method is simple operation, good recovery of limb function, can obviously reduce the probability of amputation, improve the patient's quality of life, is a worthy of clinical application of promotion technique. However, it needs to be emphasized that the patient needs early diagnosis and treatment, so as to obtain the best treatment time and obtain the best therapeutic effect.

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