



## Buerger's Disease (Thromboangiitis Obliterans)- Management by Ilizarov's Technique of Horizontal Distraction-A Prospective Interventional Study

By

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### Abstract

In Buerger's disease, the effectiveness of conservative treatment remains uncertain. Arterial reconstructive surgery is not a viable option, and sympathectomy plays only a limited role. As the disease progresses, amputation becomes inevitable. The Ilizarov method has been shown to enhance vascularization in ischemic limbs. A prospective Interventional study was conducted on 60 patients who underwent this technique. Immediate outcomes were assessed based on factors such as rest pain, skin color, venous return, limb temperature, oxygen saturation measured by pulse oximetry, and healing of ulcers or amputation stump wounds. Early and late results were evaluated using parameters including rest pain relief, ulcer and stump healing (with or without plastic coverage), walking capacity, return to previous occupation, and ability to move independently at home. The average follow-up period was 63 months. The immediate results were promising, with the exception of two cases requiring amputation. Early outcomes were rated as excellent to good in 56 patients, while late outcomes were excellent to good in 48 patients. Disease progression was significantly linked to continued smoking. Overall, the Ilizarov technique is a highly effective and cost-efficient approach for managing Buerger's disease.

**Keywords:** Thromboangiitis obliterans, Buerger's disease, Ilizarov, Fixator, Neo-angiogenesis, Lateral distraction

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### Introduction

Buerger's disease / Thromboangiitis obliterans (TAO) is an inflammatory disorder affecting small and medium sized arteries with unknown etiology and strong association with smoking [1]. It is a difficult disease to treat and abstinence from smoking is must to arrest the progress. Conservative treatments like vasodilators, anti-coagulants, prostaglandin therapy etc. have questionable role. Arterial reconstructive surgery is not feasible usually. Sympathectomy, though widely used works partially or not at all. Progression of the disease invariably leads to amputation [2].

In 1951, Ilizarov began to use distraction osteogenesis to treat acute fractures. Over the years, the methods and devices have evolved and its indications have been extended to treat fractures and associated complications: nonunion, chronic osteomyelitis, shortened extremity, joint contracture, and deformity [3]. In TAO affecting lower limbs a vertical

osteotomised bone fragment of tibia is slowly distracted horizontally to induce neo-angiogenesis which develops an effective collateral circulation to salvage the limb [3-6]. Only osteotomy with periosteal stripping [7], revascularising osteotransplantation [8, 9] and vascular gene therapy [10, 11] are alternative promising methods.

This is a retrospective analysis of 60 patients of TAO with grade III & IV ischemia treated by Ilizarov's technique.

### Materials & Method

This Prospective Interventional study was carried out in the Department of Orthopaedic surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from January 2018 to July 2020. 60 male patients with TAO grade III and IV ischemia were treated with Ilizarov's technique.



## Operative Technique

Pre-constructed Ilizarov's frame with two full rings and lateral distraction assembly were made according to size and side of the leg. All were operated under spinal or general anaesthesia in supine position without tourniquet. The pre-constructed frame was fixed with two olive wires in each upper and lower ring in such a way that they rest just below tibial tuberosity and at supramalleolar level respectively. The olive wires inserted as per goniometric atlas, following the safe zones. 120 pounds of tension applied to each wire before fixing. Through an anterior approach to tibia the skin & periosteum is incised and periosteum stripped. Multiple drill holes are made with a drill hole zig, 0.5 cm medial to the anterior margin of the tibia. Both anterior and posterior cortex are drilled and holes are also made on the lateral surface of tibia at ends of the corticotomy. A 5 mm osteotome/corticotome is used to complete the osteotomy (Fig. 1a, b). Care is taken to prevent fracture. Three parallel k-wires are passed through the tibia and osteotomised fragment and then replaced by olive wires sequentially after overdrilling (Fig. 2). These wires are fixed to the lateral distraction device. After 7 days of waiting period, lateral distraction (Fig. 1c) at the rate of 0.25 mm 6 hourly is done for 20 days to achieve a distraction of 2 cm. Regular dressing is done and stitches removed at 10 days. If the gangrene is not infected then we wait till demarcation is complete before doing an amputation and if infected then guillotine amputation is done primarily. With index surgery 10 forefoot & 04 hindfoot amputations and after one week 8 forefoot and 4 hindfoot amputations done. Debridement of ulcers done regularly and raw area grafted later.

Drill holes made with zig is connected with osteotome to complete the osteotomy anteriorly and laterally. b Twisting of the osteotomes in opposite direction to complete the osteotomy posteriorly. c The osteotomised fragment laterally pulled with neo-histogenesis ... Fig. 2a K wire passed from medial to lateral side in the middle of tibia (through the parent tibia [A] and the osteotomised fragment [B]) parallel to floor. b Over drilling over the K wire, medial cortex only, with a cannulated cancellous drill bit to make way ... Physiotherapy and full weight bearing with stick support was advised. Radiographs taken postoperatively and every 6 weeks till removal of frame. Femoral arteriogram was done in few cases at 4th week postoperatively as per the monetary status of the patient. After 2.5 to 3 months the Ilizarov assembly is loosened and patient allowed to walk for 2 weeks to check the consolidated tibial strength. Fixator assembly then removed without anaesthesia. A patellar tendon bearing brace / cast is given for 4 weeks.

Antibiotics were given and analgesics like paracetamol & Tramadol were used and avoiding NSAID's because of their anti-inflammatory action, which hampers neovascularisation.

### Statistics

Descriptive statistics (mean, range, standard deviation) were calculated for different values. Chi-square test for checking significance of association between attributes with p value for smoking.

Results were assessed as immediately (within 4 wks), early (at 6 months) and late (at final follow up). Immediate results took into account rest pain, colour of toe pulp/nailbed, temperature, pulse oxymeter measured oxygen saturation and ulcer/amputation stump wound healing. Early and late results were assessed by taking into account rest pain, healing of ulcers/amputation stump with or without plastic coverage, claudication distance, resumption of previous occupation and domestic ambulation.

### Excellent

No rest pain, healed ulcers or amputation stump, no claudication, resumption of previous occupation and unaffected domestic ambulation.

### Good

Absence of rest pain, healed ulcers or amputation stump, claudication distance of 1–2 kms, but able to continue previous occupation and domestic ambulation affected sometime.

### Fair

Absence of rest pain, persisting / recurrent ulcers, claudication distance of < 1 km, change to alternative occupation and affection of routine domestic ambulation.

### Poor

Major amputation was necessitated.

## Results

**Table: I**

Parameter	Value
Mean Age at Presentation	43.22 ± 5.03 years (Range: 29–56 years)
Mean Age of Disease Onset	39.37 ± 3.87 years (Range: 27–48 years)
Smoking History	Heavy smokers (24.83 ± 5.37 bidi/cigarette daily)
Smoking Duration	Mean: 21.57 ± 4.35 years (Range: 12–35 years)
Tobacco Chewing	10 patients
Rest Pain & Intermittent Claudication	Present in all patients
Claudication Distance	<10 meters: 08 patients 11–50 meters: 34 patients 51–100 meters: 10 patients >100 meters: 08 patients
Non-healing Ulcers	26 patients

Parameter	Value
Gangrene (varying degrees)	14 patients
Trophic Changes	Present in all patients

**Table: II:**

Parameter	Value
Mean Follow-up Duration	5.4 years (Range: 2–11 years)
Rest Pain Disappearance	By 2nd week: 45 patients
	By 4th week: 13 patients
Need for Analgesia Reduction	In all patients after 2 days
Improvement in Skin Warmth & Toe Pulp/Nailbed Color	In all patients by 10 days
Healing of Ulcer/Gangrene	Signs of healing in all by 2 weeks
Oxygen Saturation Improvement	In all patients
Early Results	Excellent: 42 patients
	Good: 14 patients
	Fair: 2 patients
	Poor: 2 patients
Late Results	Excellent: 34 patients
	Good: 14 patients
	Fair: 6 patients
	Poor: 6 patients

## Discussion

The study demonstrates promising outcomes in patients with severe ischemic symptoms, all of whom were heavy smokers with a prolonged history of tobacco use. Despite a mean disease onset at 39.37 years and a mean presentation age of 43.22 years, the results indicate a significant improvement in clinical symptoms following intervention.

A key finding was the rapid relief of rest pain, which disappeared within two weeks in the majority of patients (45 out of 62) and by four weeks in the remaining 13. The need for analgesia was significantly reduced within just two days, highlighting the effectiveness of treatment in controlling pain. Additionally, skin warmth and improvements in toe pulp and nailbed coloration were noted in all patients within 10 days, reflecting enhanced peripheral circulation.

Tissue healing was another crucial outcome, with all patients exhibiting signs of ulcer and gangrene healing within two weeks. This suggests that the intervention not only improved perfusion but also facilitated wound recovery, reducing the risk of further complications such as limb loss. Furthermore, oxygen saturation levels improved across all patients, further reinforcing the physiological benefits of treatment.

The evaluation of early and late results revealed encouraging long-term benefits. Early outcomes were classified as excellent in 42 patients, good in 14, fair in 2, and poor in only 2 patients. Over time, there was a slight shift in outcomes, with late results showing excellent improvement in 34 patients, good in 14, fair in 6, and poor in 6. While the overall results remained positive, the slight decline in excellent outcomes over time suggests the necessity for long-term follow-up and possibly additional interventions in some cases.

These findings highlight the effectiveness of the treatment approach in restoring perfusion, alleviating symptoms, and promoting tissue healing. However, the study also underscores the importance of addressing risk factors such as heavy smoking and tobacco chewing, which are known contributors to vascular diseases. Given the high prevalence of these risk factors among the study participants, aggressive smoking cessation strategies should be incorporated into management plans to ensure sustained long-term benefits.

Despite the positive results, the study has some limitations. The loss of follow-up of 17 patients may have introduced some degree of selection bias. Additionally, while the early and late outcomes were generally favorable, the persistence of fair and poor outcomes in a subset of patients suggests that further research is needed to optimize treatment strategies and improve long-term prognosis.

In conclusion, this study demonstrates significant symptomatic relief and functional improvement in patients with severe ischemic symptoms. The rapid pain relief, improved perfusion, and high rates of ulcer healing indicate that the intervention was largely successful. However, long-term follow-up and lifestyle modifications remain crucial for maintaining these benefits and preventing disease progression.

## Conclusion

TAO is grave problem faced by poor patients of developing and underdeveloped countries, with diagnosis and treatment still obscure. Ilizarov's method is a low cost technically simple procedure, with excellent results in grade III and IV limb ischaemia and can be done in small operative setups in our country. Long term prospective randomized controlled trials are needed to establish this procedure as the first line treatment. Results of newer promising modalities are awaited. Till then, the quest for an ideal treatment of this enigmatic limb threatening condition will continue.

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