

Laser angioplasty and thrombolytic treatment for femoral artery occlusion

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Among 27 patients with femoral artery occlusion that were treated by transluminal Nd:YAG laser angioplasty, in 16 patients the procedure was combined with intraarterial infusion of rTPA (Actilyse – Boehringer Ing).

In 5 out of 11 patients from the initial group recanalization was not successful. In 16 patients from rTPA group satisfactory immediate results were achieved in all cases. In long time observations ranging from 9 to 24 months all patients remained free from symptoms, although in 4 out of them angiography and Doppler ultrasound examination reveal no flow in femoral artery. In the remaining 12 patients (75%), the previously occluded artery is patent.

No complications of laser angioplasty nor intraarterial infusion of rTPA were noted in this series.

Key words: arterial occlusive diseases-therapy; femoral artery; thrombolytic therapy; angioplasty, laser

Introduction

Laser angioplasty is the new method of treatment in some cases of arteriosclerotic occlusion of peripheral arteries, resulted in ischemia of lower extremities.¹⁻⁴ Among different laser applicators, the Neodymium: Yttrium – Aluminium – Garnet laser (Nd:YAG) appeared to be the most suitable instrument for such procedure.⁵⁻⁷ Compared to other lasers, the Nd:YAG is much more powerful and allows to perform angioplasty with sapphire or ceramic tips at the end of laser fiber. This contact method of laser

recanalization is performed in different centers and generally accepted, as presented in many publications.⁸⁻¹⁰

Many observations also indicate that mechanical or thermal methods of the artery recanalization should be combined with thrombolytic treatment. The recombinant tissue-type plasminogen activator (rTPA) seems to be the best agent in these cases, much more safe and effective than urokinase or streptokinase.¹¹⁻¹⁴

We would like to present our own experience in the treatment of femoral artery occlusion with the method of laser angioplasty, combined in 16 cases with intrarterial infusion of rTPA.

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Materials and methods

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In the Clinic of General Surgery & Liver Dise-

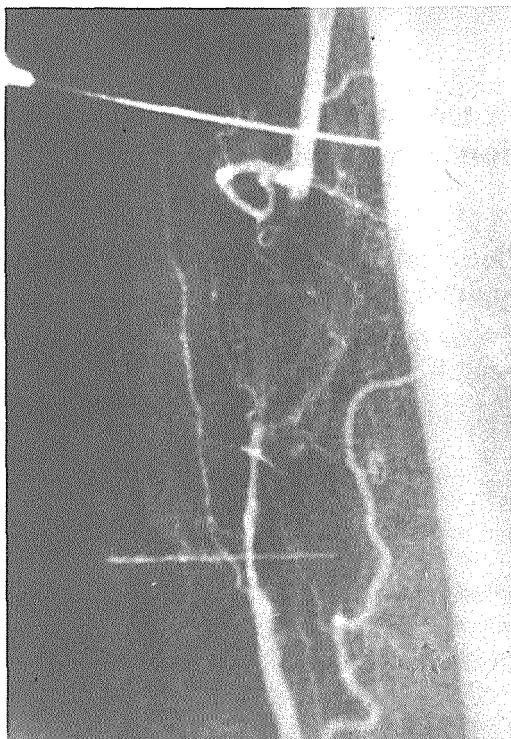


Figure 1. Initial arteriography just before recanalization.

ases and the II Department of Rentgenodiagnosis, Medical Academy of Warsaw, the procedures have been performed since 1991. We use SLT (Surgical Laser Technology), Nd:YAG laser and contact method of vaporization.

The laser fiber is introduced to the lumen of artery in antegrade fashion by Seldinger technique, and angiography is performed to localize precisely the proximal wedge of occlusion. Then the sapphire tip is positioned close to it under fluoroscopy. Recanalization is proceeded in step by step fashion with 8 to 12 watts, at 1 second of power output. The position of the laser fiber tip and the state of recanalization is continously observed under fluoroscopy during the time of procedure. Arteriography is made as well, by means of infusion of small amount of contrast medium after each step of recanalization (Figure 1).

When the recanalization of artery is successfully achieved, the laser fiber is passed through the place of occlusion for several times to

enlarge lumen of recanalized artery and make the canal more smooth. Despite of successful laser recanalization, the procedures were completed with baloon angioplasty in all cases (Figure 2, Figure 3).

The procedure was carried out in 27 patients, 20 males and 7 females. The average age was 58. In all cases the diagnosis was established by arteriography and ultrasound Doppler examination which indicated femoral artery occlusion, ranging from 2 to 16 cm in length. All patients suffered from ischemia of lower extremity for several weeks and were in II – III stage of ischemia, according to Fontain scale. All of them were excluded from operative treatment due to respiratory and circulatory insufficiency, or did not want to be operated upon. A day prior to the procedure, all patients received 3 tablets of aspirin. On the day of procedure, in the initial group of 11 patients we used heparin, administered as bolus injection in dose of 5000 u., followed after recanalization by intra-

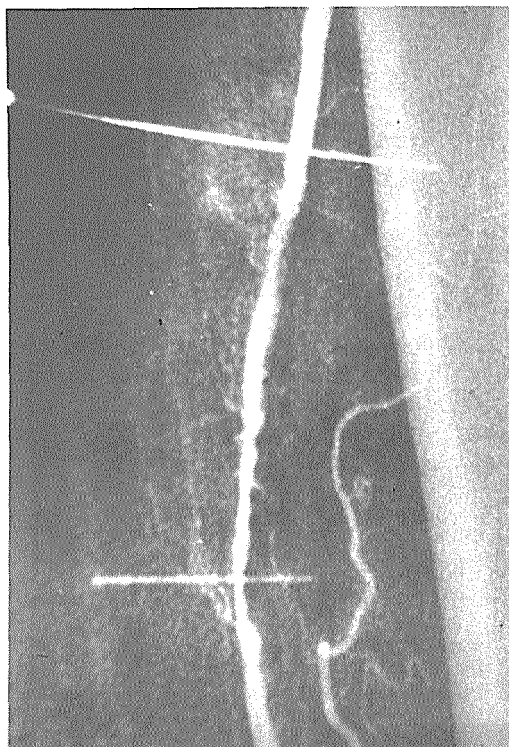


Figure 2. Successful recanalization was achieved.

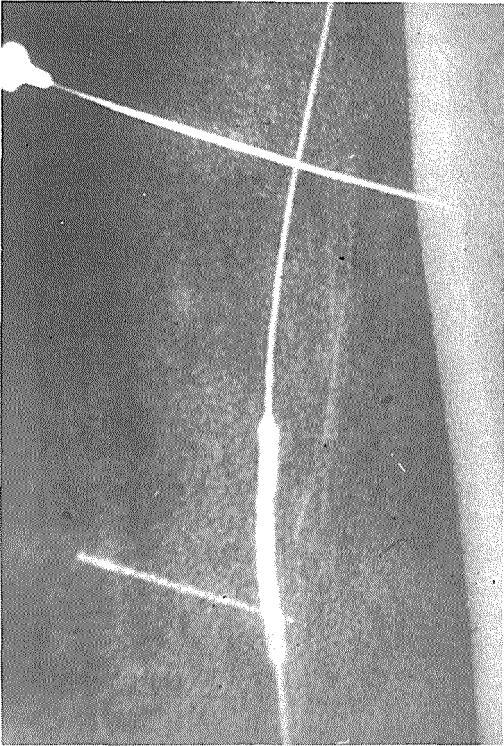


Figure 3. Laser procedure is completed with balloon angioplasty.

venous infusion of heparin in dose of 1000 u./hour during 2–3 days.

In the next group of 16 patients laser angioplasty was followed by infusion of rTPA (Actilyse – Boehringer Ing.) in dose of 2 mg / hour administered intraarterial during 10 hours.

All patients were treated subsequently with dicumarol and the flow through the femoral artery was controlled by clinical and Doppler ultrasound examination.

Results

In the initial group of 11 patients, treated with laser angioplasty and heparin, in 5 patients the procedure failed. In 3 of them perforation of the artery occurred, resulting in immediate leg amputation in 2 patients. In 2 others laser recanalization was not successful, followed the amputation of extremity soon. Two patients died.

In 6 patients successful recanalization of the artery was achieved and they were discharged from hospital free from symptoms.

In the group of 16 patients, treated with laser-balloon angioplasty and the infusion of rTPA, complications have not been noted. Full recanalization of artery and the release of symptoms was achieved in all cases, as confirmed by arteriography done at the end of procedure in each patient (Figure 4, Figure 5).

All patients who underwent successfully recanalization, remained free from symptoms from 9 to 24 months, averagely 9 months. As confirmed by Doppler ultrasound examination, the

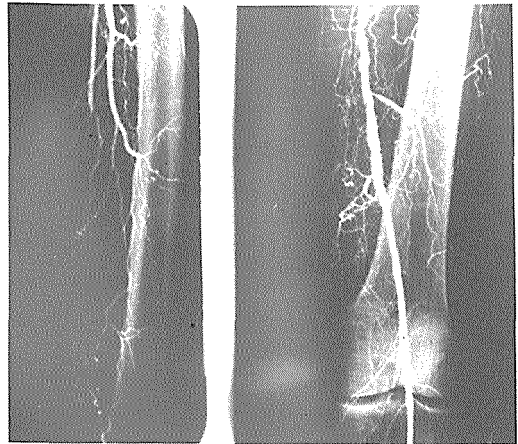


Figure 4. Arteriography before and after recanalization in patient with femoral occlusion.



Figure 5. The same situation in patient with popliteal occlusion.

artery is patent in 70%, with normosystolic flow through the recanalized lumen. In 30%, Doppler usg indicates structure or partial reocclusion of artery, however, there are no symptoms of ischemia observed, at the distal part of the extremity in these patients.

Discussion

Transluminal laser-balloon angioplasty is a relatively new method of treatment, however, in few centers around the world hundreds of such procedures have been done successfully. The observations indicate that the laser recanalization, especially when combined with thrombolytic treatment, may be as effective as surgery in some cases of artery occlusion due to arteriosclerosis.^{1-3,5,7-9}

Our observations seem to confirm the others experience. Effective recanalization of the artery was achieved by contact Nd:YAG laser vaporization in most of our patients. The best results were observed in the middle-aged patients, in whom the length of occlusion did not exceed 7-8cm and was localized in canal of Hunter. The longer occlusions and occlusions localized in popliteal artery, especially in old patients were much more complicated.^{15,16}

The procedure of laser angioplasty is generally free from pain, except the infusion of contrast medium. During procedure maximum attention must be given to the position of the laser tip inside the artery. All the time when the laser beam is applied, the tip should remain in touch with atheromatous plaques. The applieance of laser energy without close contact to the occluding changes increases thermal damage but diminishes the efficacy of vaporization and may cause perforation of the artery. Thus the laser fiber should be pushed very gently along the artery, always against the delicate resistance at the end of the fiber.

On the other hand, one should be very careful and not push the fiber too hard. It is relatively stiff and may produce mechanical perforation of the wall of artery. Pain that is felt by patients is usually the only one but the most important signal of perforation. This se-

rious complication occurred in 3 out of 11 patients from the first group, to whom laser angioplasty was applied initially. Undoubtedly, uncomplicated recanalization that was achieved in the second group of 16 patients treated with additional infusion of rTPA should be related to increasing experience and more knowledge in the laser use. Also the patients were chosen to the procedure much more carefully, as well.

The perforation of artery is the most serious problem. Thermal and mechanical damage during the procedure are the most common reasons for this complication. The damage might be the result of faults in the laser tip construction resulting in non-axial distribution of emitted energy. More often it is caused by technical faults in the procedure itself. Nevertheless, it is not necessary to terminate the procedure when perforation of the arterial wall occurs. According to ghe majority of observations the final outcome depends on successful recanalization of the artery and restoring of normal blood flow distally to the occlusion. Therefore the procedure should be continued, unless recanalization could not be achieved.^{1-4,6}

The recanalized part of artery presents itself as an irregular canal. In some places strictures and persistent occlusions may be seen. They cannot be vaporized with the laser without the risk of artery perforation, so the procedure must be completed by balloon dilatation. This remains the golden standard of the laser angioplasty. The supposition that the arterial wall after laser recanalization is fragile and more prone to rupture from the balloon pressure is not confirmed by clinical observations.^{5,7-10}

It is currently proposed to combine thermal or mechanical angioplasty with additional thrombolytic therapy. The potency of different agents for thrombolysis and farmacologic recanalization of the artery occluded by atherosclerosis is well known. According to some observations recombinant tissue-type plasminogen activator (rTPA) presents the highest thrombolytic potency and is much more effective and safe than streptokinase or urokinase. Short time of activity of rTPA may be easily and effectively controlled, enable if necessary, ope-

rative treatment also in emergency conditions. Indication for thrombolytic therapy is peripheral ischemia observed in some patient after angioplasty procedure. It may occur despite of successful recanalization of the main arterial trunk and is presumably caused by emboli in peripheral arteries due to remnants of arteriosclerotic plaques fragmented during the procedure. Therefore, thrombolytic treatment seems to be the logical support of transluminal angioplasty.¹¹⁻¹⁴

Intraarterial infusion of rTPA (Actilyse Boehringer Ing.) was very well tolerated in our patients. No complications nor side effects were observed during the treatment. We did not observe any reocclusion nor peripheral thrombosis.

Our observations presented in this paper represent preliminary experience in the treatment of lower extremity ischemia due to arteriosclerosis with percutaneous, transluminal methods. The small number of patients does not permit us to draw definite conclusions. It seems, however, that transluminal laser-balloon angioplasty combined with thrombolytic treatment with rTPA is effective and may be an alternative to surgical treatment in selected cases.

Conclusions

1. Nd:YAG laser balloon angioplasty may be effective method of treatment in selected cases of femoral artery occlusion.
2. Additional intraarterial infusion of rTPA improves the effects of laser balloon angioplasty.

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