

Full Length Research Paper

Color Doppler ultrasonography observation of alprostadil injection for diabetes mellitus involved in lower limb vessels

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The aim of this study is to observe the clinic result of alprostadil injection for diabetes mellitus patients with lower limb vessels disease which was evaluated by color Doppler ultrasonography. 650 cases of diabetes mellitus with lower limb vessels disease treated by alprostadil injection and followed up by color Doppler ultrasonography to observe the blood flow dynamics inside the vessels and the range of color Doppler ultrasonography. After treatment by alprostadil injection, the interior diameter of vessels increased, blood flow increased and color Doppler ultrasonography spectrum narrowed with relief of clinic symptom. Thus, color Doppler can make a rapid and exact diagnosis to the vessel diseases, and can give a guide to the prognosis and nursing.

Key words: Diabetes mellitus, lower limb vessels, color Doppler ultrasonography, alprostadil.

INTRODUCTION

Diabetes lower limb vascular lesions is the most common chronic complications of diabetes and one of the main causes of disability, which makes progress fast and has a high morbidity, affecting the quality of patients' life seriously (Pan et al., 2001). In recent years, the development of prostaglandin E1 fat micro ball carrier injection (LpoPGE1) has made satisfying results in alprostadil injection for diabetes mellitus patients with lower limb vessels disease (Yan et al., 2005; Lei, 2007; Wu, 2007).

However, at present, color Doppler ultrasound observation of improving lower limb blood vessels, and the effect of alprostadil has drawn many attention, so the author has made some observation of this aspect. Since 2006, the Sino-Japanese Friendship Hospital and Beijing millennium hospital have made treatments of 650 patients of diabetes lower limb vascular lesions with alprostadil, using color Doppler ultrasound to observe the patients' blood dynamics, blood vessel diameter and spectrum width. The results of ultrasound observations are shown subsequently.

MATERIALS AND METHODS

Cases choice

Patients (650) were chosen in our hospital from May 2006 to May 2008, which accorded with the 1999 World Health Organization (WHO) diagnosis standards of diabetes, and among them, there were 349 male cases and 301 female cases, and their age ranged from 25.4 to 65.5.

The time span of the disease was from 8.3 to approximately 30.1 years. All the 650 cases of type 2 diabetes have the symptoms of double lower limbs numb, cool feeling, rest pain, intermittent lameness, limb gangrene, etc. The severity of double blood vessels of lower limbs was similar. At the same time, we chose another 90 normal volunteers, 45 males and 45 females, which were equal in age and gender, as a control group.

Patients were in the strict control of blood sugar, and their lower limb vascular lesions were treated with alprostadil for diabetes. 10 to 20 ml physiological saline was added into 5 to 10 µg alprostadil intravenous injection for 3 to 4 weeks as a course of treatment, without other drugs affecting the blood dynamics. GE Logq7 GE Logq9 type color Doppler ultrasound diagnostic instrument was used, for the phased array detector front, with a frequency of 7.0 to 10.0 MHz. The vascular diameter, blood flow and spectrum width of double arteria dorsalis pedis were observed.

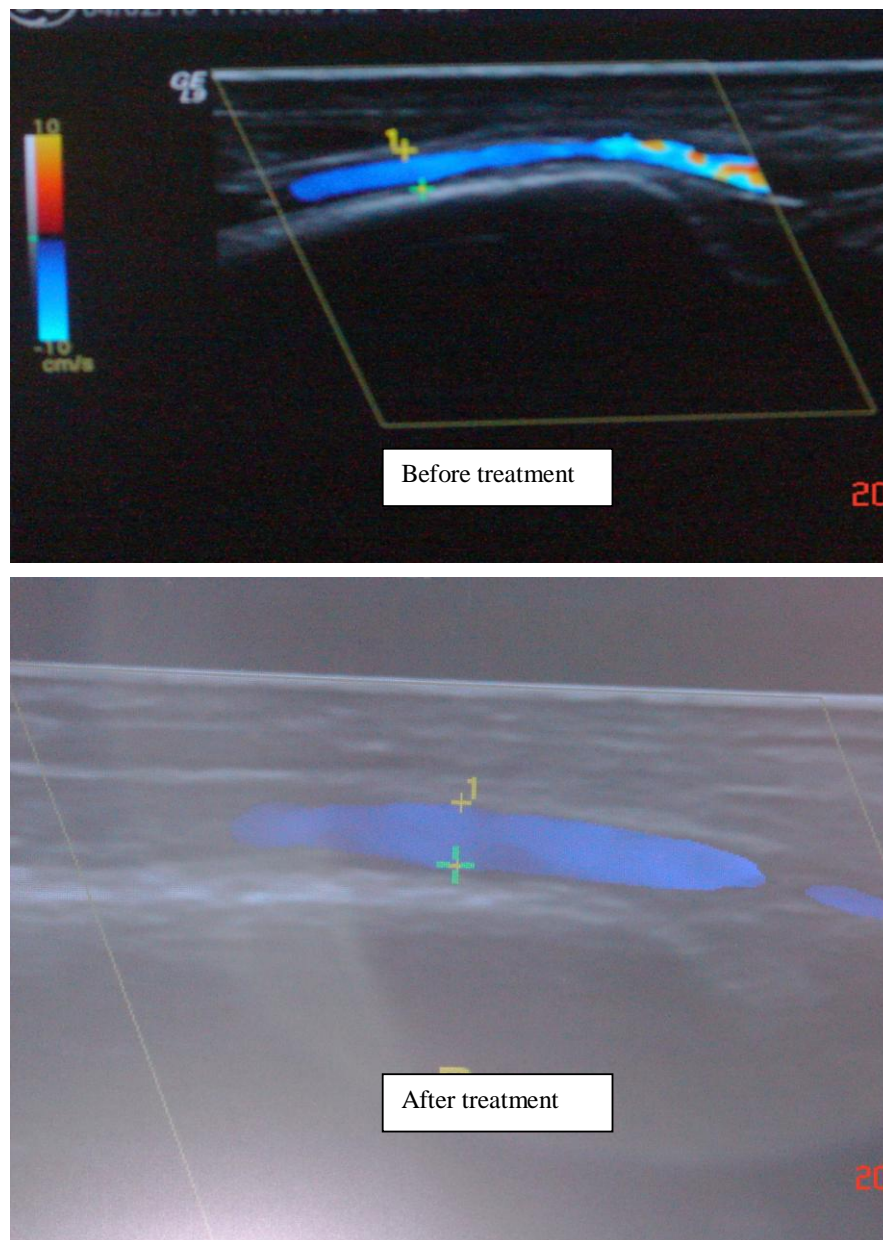


Figure 1. Color Doppler ultrasound spectrum of arteria dorsalis pedis before and after treatment.

Statistical methods

SPSS1 1.5 statistical software was used to make the statistical processing; the arithmetic mean \pm standard deviation ($\bar{X} \pm s$) was used to show the statistics, variance was used to analyze the comparison among groups and the Dunnett-t was used to test it. $P < 0.05$ makes sense in Principle of Statistics.

RESULTS

Before receiving the treatments, patients' double arteria dorsalis pedis inside diameter were narrow, with little

blood flow, and the spectrum width was wide; after the treatments, inside diameter of blood vessels became wider, with obvious improvements of blood flow, and the spectrum width became narrower (Figure1). The comparison made significant senses ($P < 0.01$). In accordance with the improvement of symptoms showed by Doppler ultrasound results, the symptoms of double lower limbs numb, cool feeling, rest pain, intermittent lameness and limb gangrene became softer or disappeared. There were no patients suffering with bleeding, diarrhea, or abdominal distension, only 5 cases felt headaches and dizziness, which disappeared after

Table 1. The results of vascular inside diameter, blood flow, and spectrum width observed by color Doppler ultrasound.

Blood vessel	Group	Diameter (mm)	Blood flow (cm ³ /s)	Spectrum width (mm)
Right arteria dorsalis pedis	Control group	1.89 ± 0.45	1.31 ± 0.59	4.00 ± 1.11
	Before treatment	1.27 ± 0.22 ^Δ	0.72 ± 0.49 ^Δ	5.88 ± 1.45 ^{ΔΔ}
	After treatment	1.81 ± 0.42 ^{**}	1.22 ± 0.83 [*]	4.54 ± 0.90 ^{**}
Left arteria dorsalis pedis	Control group	1.90 ± 0.31	1.22 ± 0.49	4.21 ± 1.20
	Before treatment	1.44 ± 0.38 ^{ΔΔ}	0.64 ± 0.66 ^Δ	5.79 ± 1.26 ^{ΔΔ}
	After treatment	1.72 ± 0.38 [*]	1.02 ± 0.61 [*]	4.97 ± 1.26 ^{**}

Compared with before treatment *P < 0.05, **P < 0.01; compared with control group ^ΔP < 0.05, ^{ΔΔ}P < 0.01.

the experiment, and there were 4 cases whose blood vessels ached and became red. The results of vascular diameter, blood flow and spectrum width before and after the treatment are shown in Table 1.

DISCUSSION

Diabetes atherosclerosis happens early, makes progress fast, and causes serious condition, mainly affecting the far arteries of double lower limbs, for diabetes patients, often leads to lower limb atherosclerosis, increase of blood viscosity, thrombosis and obstacles of microcirculation (Zhou, 2001; Luo, 2002). Prostaglandin E (PGE) has the function of expanding the blood vessels, inhibiting the aggregation of platelet, and promoting the deformation of erythrocyte, increasing the blood flow of local resistance and urokinase in thrombus parts; in addition, it can stimulate the blood endothelial cells to produce the type plasminogen activator (t-pa), and dissolve clots. Alprostadil is a new type of fat micro ball carrier agent, and with the assistance of phagocyte in the body, it can release the PGE, which unites with PGE receptors on the vascular smooth muscle and platelet membrane and comes into play, thereby, it is able to outspread blood vessels, inhibit platelet aggregation lesions, improve blood circulation, increase efficient blood flow of end circulation, reduce blood viscosity, prevent blood clots, and recover the functions of the ischemia parts. Studies have shown that the speed of blood in patients' arteria dorsalis pedis, arteria dorsalis pedis' systolic blood pressure and API increase with injection of alprostadil, indicating that it can expand blood vessels and improve the microcirculation of patients (Shang, 1996).

Many past researches show that the vascular diameter of diabetes group is significantly narrower than the control group, and the most obvious position are arteria dorsalis pedis (P < 0.01), and the second obvious position are lower limb pathological changes arteries (P < 0.05); apart from these, the blood flow becomes less than the control group, arteria dorsalis pedis are distinct (P < 0.05), so does the speed of blood of the arteria dorsalis

pedis (P < 0.05), and the popliteal artery is on the second position; at the same time the blood flow spectrum broadens in different degree, and arteria dorsalis pedis are obvious (P < 0.01), followed by the popliteal artery (Zheng et al., 2004). On the basis of the earlier discussion, a conclusion was drawn that the most significant change of pathological changes of lower limb arteries are about arteria dorsalis pedis; so, in this study, we regard the color Doppler ultrasound spectrum of double arteria dorsalis pedis as the evaluation criterion of alprostadil.

Color Doppler ultrasound was used to observe the changes of diabetes patients with lower limbs vascular lesions before and after receiving the treatment of alprostadil, involving the inner diameter, blood flow, and spectrum width of the back foot's blood vessels. It was found that after receiving the treatment of alprostadil, patients' diameter of arteria dorsalis pedis increases, blood flow speed faster, and blood flow spectrum becomes narrower, which are close to the related indicators of normal control group, and are in accordance with the results of clinical symptoms improvement. The biggest advantage of color Doppler ultrasound detection is that according to the blood dynamics indicators, we can accurately (accuracy > 90%) diagnose diabetes lower limb vascular lesions early before the blood vessels become obviously narrow, then timely treatment and nursing can be taken, avoiding amputation and disability. In addition, alprostadil is a new type of fat micro ball carrier agent, which can dilate blood vessels and inhibit platelet aggregation, so it may cause side effects of skin redness, gums bleeding, blood vessels pain, phlebitis, etc., however, with the attention in the process of the treatment and timely corresponding treatment measures, these side effects can be prevented.

Conclusively, alprostadil is a kind of common medicine in the treatment of diabetes lower extremities of vascular lesions. Color Doppler ultrasound is a kind of simple operation, with low cost, high accuracy, no wound, and strong ermittelte repeatability means; it is a good method of early diagnosis of diabetes lower vascular lesions, and is also an effective method of evaluation of alprostadil treatment. Diabetes patients receiving the treatment of

alprostadil should take the ultrasound inspection of lower limb arteries regularly, and according to the condition, doctors should decide the treatment and recovery means. On the basis of basic treatment, comprising physical, sports, and psychological recovery treatment, disability or death can be avoided, and the quality of diabetic patients' life can be improved.

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