

Short Communication

Effects of alprostadil on hemodynamic parameters of intrinsic artery of kidney in the early stage of renal inadequacy in diabetic nephropathy observed by color doppler ultrasonography

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To investigate the effects of alprostadil on the change of hemodynamic parameters of intrinsic artery of kidney in the early stage of renal inadequacy in diabetic nephropathy and the application value of color doppler ultrasonography. Thirty normal subjects were in control group, while fifty subjects were in the treatment group who were diagnosed as being in the early stage of renal inadequacy in diabetic nephropathy. Color doppler ultrasonography was used to examine the segmental renal artery (SRA), interlobular artery (IRA) and arcuate renal cortex artery (ARA), meanwhile observation and analyses were made towards its peak systolic blood flow velocity (V_{smax}), end diastolic blood flow velocity (V_{dmin}) and pulse index (RI). Compared with the control group, V_{dmin} and V_{smax} of SRA, ARA and IRA was reduced markedly before Alprostadil treatment, but RI rised remarkably (P<0.05). V_{smax} of SRA and V_{dmin} of SRA and ARA were up evidently (P<0.05), but RI decreased significantly (P<0.05). Color doppler ultrasonography is of value in assessing renal inadequacy of diabetic nephropathy. Alprostadil plays an active role in improving renal bloodstream in the early stage of renal inadequacy in diabetic nephropathy, and RI can be served as a sensitive index to evaluate its effect.

Key words: Diabeticnephropathy, color doppler ultrasonography, alprostadil, intrinsic artery of kidney, resistance index.

INTRODUCTION

Diabetic nephropathy (DN) is a major microvascular complication of diabetes. It is also the main reason of death and disability which caused by diabetes. The final results of DN will lead to the development of renal impairment which seriously endangers the patient lives. Currently, there are no good measures for preventing and controlling DN, and lack of particular drugs to treat it. Alprostadil injection can be used to treat limb ulcers caused by chronic arterial occlusive disease and limb pain caused by circulatory disturbance of tiny blood vessels. It also improves cardiovascular and cerebrovascular microcirculation. It has been reported

that Kaishi injection treatment of early DN achieves satisfactory results (Zhao and Jiang, 2007). Fuming et al. (2009) use alprostadil to treat elderly patients with early diabetic nephropathy. Two weeks later, urinary protein excretion of patients decreased significantly compared with before treatment which suggests that diabetic nephropathy alprostadil plays significant part in the early stage of diabetic nephropathy. Detection of renal hemodynamics in patients with diabetes is very important for early detection of kidney damage. We used color doppler ultrasound to observe the impact of renal artery flow spectrum of diabetic treated with alprostadil between March 2008 and February 2009 in our hospital, explore the value of doppler ultrasound in early diagnosis of renal dysfunction in diabetic patients, and further confirmed alprostadil can increase renal blood flow and

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Table 1. Changes in the parameters of renal artery ($\bar{X}\pm S$).

Vascular	Group	RI	Vsmax (cm/s)	Vsmax (cm/s)
SRA	Control group (n=30)	0.52±0.03	50.73±5.10	20.12±3.70
	Treatment group (n=50)	0.63±0.05*	40.51±13.14*	16.12±1.90*
	Before treatment	0.57±0.05#	46.21±9.79#	19.11±4.21#
	After treatment			
IRA	Control group (n=30)	0.50±0.03	34.12±4.43	16.12±1.90
	Treatment group (n=50)	0.60±0.05*	28.10±9.01*	13.12±2.01*
	Before treatment	0.56±0.05*	28.13±7.10	16.11±2.02#
	After treatment			
ARA	Control group (n=30)	0.48±0.03	22.01±3.31	8.98±1.09
	Treatment group (n=50)	0.63±0.05*	10.09±4.59*	6.98±1.33*
	Before treatment	0.55±0.05#	19.29±5.10	7.21±3.01
	After treatment			

Compared with control group* $P < 0.05$, compared with before treatment # $P < 0.05$.

reduce urinary protein, as reported .

OBJECTS AND METHODS

General information

Fifty patients, 26 males and 24 females, aged 36 to 70 years (53 years), with early chronic renal failure of Type 2 diabetes. Thirty healthy subjects, 16 males and 14 females, aged 36 to 71 years (52.12±9.18 years), being the control group. Clinical data of two groups had comparability.

Treatment method

Both of the two groups were given low-fat, high-carbohydrate, high-fiber diet (quality protein 40 g each day), then used diet therapy and sugar descending drug to control blood sugar, FPG concentration of 6 to 7 mmol/L and PBG concentration of 7 to 9 mmol/L. And the blood pressure should be control. In addition to conventional conservative treatment, the patients in treatment group were given injective Kaishi (Beijing Taide Pharmaceutical Company Limited) 10 µg+0.9% NS 100 mL iv drip, qd, for fifteen days. Antiplatelet drugs, anticoagulation drugs and ACEI were avoided to be used during this period. The patient's RI, S/D (S: Vsmax, D: Vdmin) of SRA, IRA and ARA were measured respectively in half mouth before and half mouth after the operation.

Indexes analysis

Voluson 730 and IU22 color doppler sonography transducer frequency 3.5 MHz were performed in this study. The volume of doppler sample is 2 mm and incident angle is 60°. Under lateral recumbent position, studying the fasting subject's SRA, ARA and IRA with color doppler flow imaging, and the RI, S/D (S: Vsmax, D: Vdmin) of SRA, IRA and ARA were measured, respectively. Calculating the average of 3 to 5 cardiac cycles of renal artery.

Statistical method

The measurement data was expressed as $X\pm S$, the differences

among groups were compared with analysis of variance and Dunnett-T test, and the difference was significant when $P < 0.05$. All the data were analysed by using SPSS 11.5 statistic software.

RESULTS

The performance of renal doppler color flow images of renal

Control group

The images of renal blood flow in control group showed plentiful blood supply, and the distribution of renal blood flow signals from renal artery to the arcuate artery segment showed a progressively branching color flow images. Before treatment, the renal artery flow signal is Fairport of the interlobar artery blood flow show for flow signals of different thickness, part of the arcuate artery blood flow decreased. After treatment, the renal blood supply is rich, the renal sinus segment artery and interlobar arteries are clear and the arcuate artery blood flow signal is clearly visible.

Changes in renal blood flow parameters

Compared with the control group, Vdmin and Vsmax of SRA, ARA and IRA were reduced markedly before Alprostadil treatment, but RI rised remarkably ($P < 0.05$). Vsmax of SRA and Vdmin of SRA and ARA went up evidently ($P < 0.05$), but RI decreased significantly ($P < 0.05$) (Table 1).

Conclusions

The pathological features of diabetic nephropathy are

diffuse glomerular sclerosis, increased renal artery RI and renal blood perfusion changes (Rossing et al., 2004). Both Type 1 and 2 diabetes mellitus involve the abnormal changes of renal hemodynamics (Kveder et al., 2001). The diastolic blood flow velocity of renal arteries indicates the renal blood perfusion. RI shows the resistance of renal capillary and indicates the extent of intrarenal artery damage at different stages of diabetic nephropathy (Nosad et al., 2006). There is a positive correlation between RI and the severity of diabetic nephropathy (Sun and Liu, 2005).

The result of this study shows that intrarenal artery RI was significantly increased at the early stage of DN with renal insufficiency. This result is significant for preventing and diagnosing the renal damage in type 2 diabetes. The early renal dysfunction can be evaluated with RI. According to the report in literature, the intrarenal artery RI in DN cases is significantly higher than that in non-diabetic nephropathy (NDN) cases (Matsumoto et al., 2000). Color doppler ultrasound is of clinical value in detecting the intrarenal artery RI in DN cases.

Some scholars regarded that in early renal dysfunction of DN, the end-diastolic V_{min} of SRA and IRA decreased and their RI increased. IRA RI >0.65 indicated the early renal dysfunction (Gao and Panda, 2004). Kai Shi Injection is a new preparation in which the PGE₁ is wrapped in lipid microspheres. This injection has strong vasodilative effect and has been applied in treating many chronic complications of diabetes.

Kai Shi injection has target effect on spastic artery to dilate the vessel. At the same time, PGE₁ has the actions of inhibiting the synthesis of TXA₂ and the formation of platelet and immune complex, dilating the microvessel, relieving hypercoagulability, increasing renal blood flow, preventing renal glomerulus thrombosis, increasing renal blood flow, inhibiting the activity of renin-angiotensin system and reducing the internal pressure of efferent glomerular arteriole (Okada et al., 1993).

Another research found that PGE₁ had the action of inhibiting immune reaction. It inhibits the activity and formation of cytokines and relieves inflammatory reaction to protect kidney and improve renal function (Zhang, 2002). This study shows that RI is the most sensitive

index for observing intrarenal artery blood flow. Kai Shi injection has positive effect on improving the blood flow in DN cases. RI can be used as an important index for evaluating the effect of Kai Shi injection on early renal dysfunction in DN cases.

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