

Clinical utility of far-infrared therapy to improve access blood flow and needling pain in hemodialysis patients

Soo Jeong Choi¹, Eun Hee Cho², Jong Hye Kim², Samuel Park¹, Changwook Min¹, Hye Min Jo¹, Moo Yong Park¹, Jin Kuk Kim¹, and Seung Duk Hwang¹

¹Division of Nephrology, Department of Internal Medicine, Soonchunhyang University College of Medicine, ²Artificial Kidney Unit, Soonchunhyang University Bucheon Hospital, Bucheon, Korea

Background

A well-functioning vascular access and relieving needling pain are important factors for achieving adequate dialysis and improving the quality of life in hemodialysis (HD) patients. Far-infrared (FIR) therapy has been used on various medical fields such as chronic pain control and dysmenorrhea. Recent reports revealed FIR therapy improves blood flow and survival of arteriovenous fistula in HD patients. The aim of this study is to evaluate the effect of FIR therapy on access blood flow and needling pain in HD patients in Korea.

Methods

This study was a prospective clinical trial at the Soonchunhyang University Bucheon Hospital in Korea between June 2013 and August 2014. A total of 31 HD patients were enrolled in the study. FIR was used for 40 min during HD three times per week. The access blood flow (Qa) measured by the ultrasound dilution method and pain scale measured by numeric rating scale (NRS). The baseline Qa and pain scale were measured and taken the mean during one week before the start of study. They were measured on first, 3rd, 6th, and 12th month after.

Results

Table 1. Baseline characteristics of the patients

Patients (n)	Initial Qa<500ml/min (11)	Initial Qa>500ml/min (20)	P-value
Age (years)	50.3 ± 14.1	52.7 ± 6.9	0.601
Male	2 (18.2%)	10 (50.0%)	0.086
Comorbid conditions			
DM	6 (54.5%)	9 (45.0%)	0.447
Liver disease	2 (18.2%)	2 (10.0%)	0.447
Cardiovascular disease	1 (9.1%)	7 (35.0%)	0.124
Cerebrovascular disease	1 (9.1%)	1 (5.0%)	0.591
Peripheral vascular disease	1 (9.1%)	4 (20.0%)	0.405
Access type			
Arteriovenous graft	2 (18.2%)	4 (20.0%)	0.646
Medications			
Calcium channel blockers	4 (36.4%)	15 (75.0%)	0.042
Beta-blockers	5 (45.5%)	10 (50.0%)	0.553
Alpha-blockers	0 (0%)	2 (10.0%)	0.409
RAS blockers	5 (45.5%)	16 (80%)	0.060
Anti-platelet drugs	8 (72.7%)	13 (65.0%)	0.490

Effect of a single session of FIR therapy

In a total of 134 session, Qa, body temperature (BT), blood pressure (BP), and pain scale were measured before and after FIR therapy. BT increased during the single HD session with FIR therapy, while Qa and BP didn't change (table 2).

No patient experienced a burn episode during FIR therapy. Itching sensation were observed in 9 sessions. Six and 14 sessions had more bleeding and delayed hemostasis on needling sites after FIR therapy, respectively.

Table 2. Effects of a single session of FIR therapy in HD patients

	Pre FIR	Post FIR	P-value
Access flow (ml/min)	612.8 ± 229.4	615.7 ± 211.5	0.202
Body temperature (°C)	36.6 ± 0.4	37.2 ± 0.5	0.000
Systolic BP (mmHg)	139.3 ± 23.7	136.1 ± 26.4	0.086
Diastolic BP (mmHg)	67.9 ± 15.6	69.0 ± 14.9	0.251

Effect of 1 year of FIR therapy

During 9.5 ± 3.8 months, one patient transferred to other hospital. Nine patient (29%) refused to continue the FIR therapy. Total 21 patients completed for 1 year FIR therapy. Thrombosis in 10 patients occurred on 8.4 ± 4.3 months.

FIR therapy for 1 year, insignificantly, increased access blood flow from 868.4 ± 690.3 ml/min to 1082.5 ± 677.0 ml/min ($p = 0.078$). But it improved pain scale from 4.8 ± 2.9 to 2.7±2.2 during needling (figure 1).

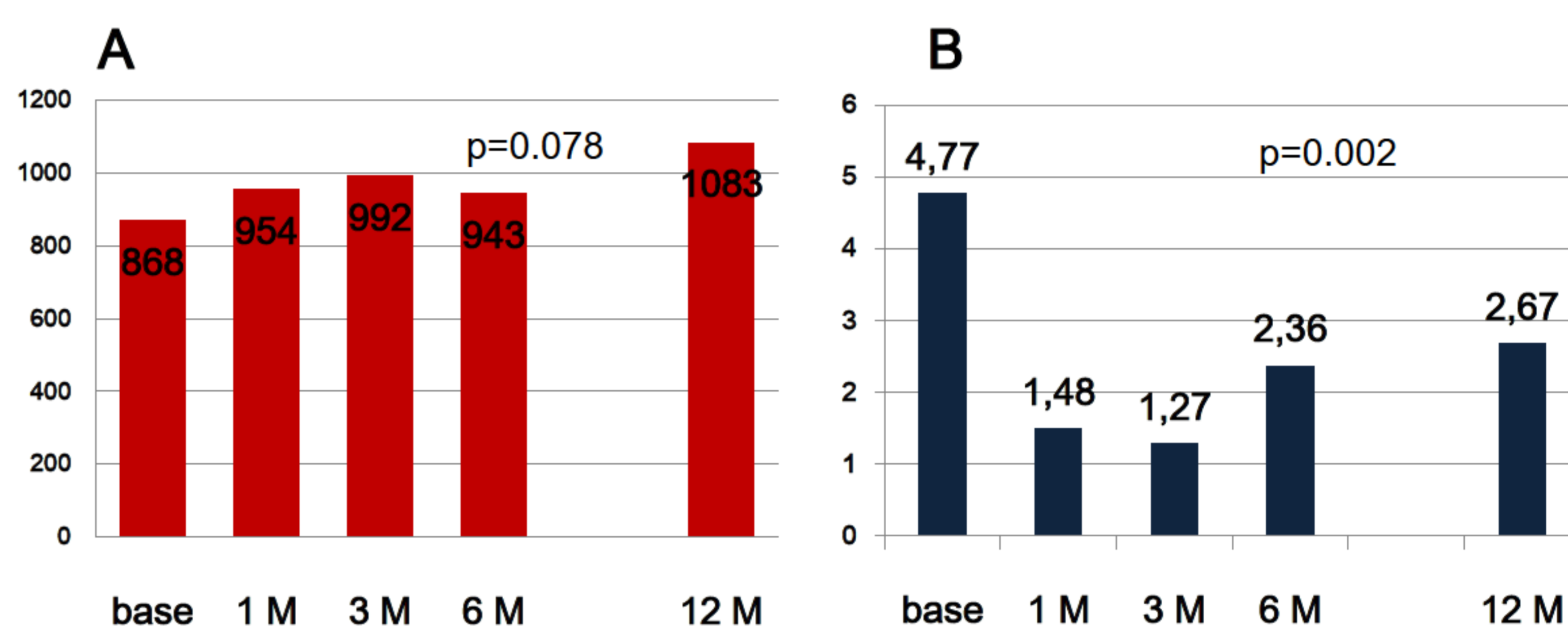


Figure 1. Effect of 1 year of FIR therapy on access blood flow (A) and needling pain (B) in 31 HD patients.

Who is more effect with FIR therapy?

Patients with initial Qa <500ml/min had more increased Qa than those with initial Qa > 500ml/min ($p = 0.021$) in FIR therapy for 1 year (figure 2A). Patients without DM had more increased Qa than those with DM in FIR therapy for 1 year (figure 2B).

Old age, liver disease, hypertension, cardiovascular disease, cerebrovascular disease, graft and medications didn't affect access blood flow (data not shown).

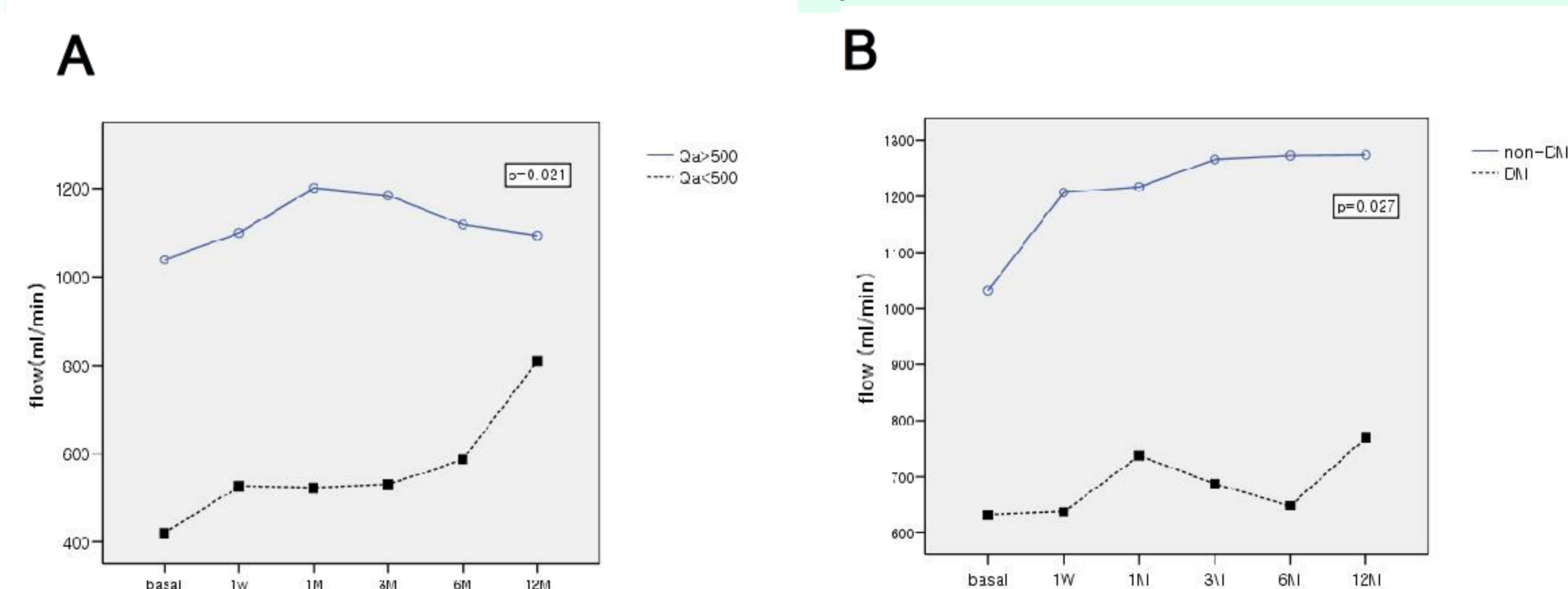
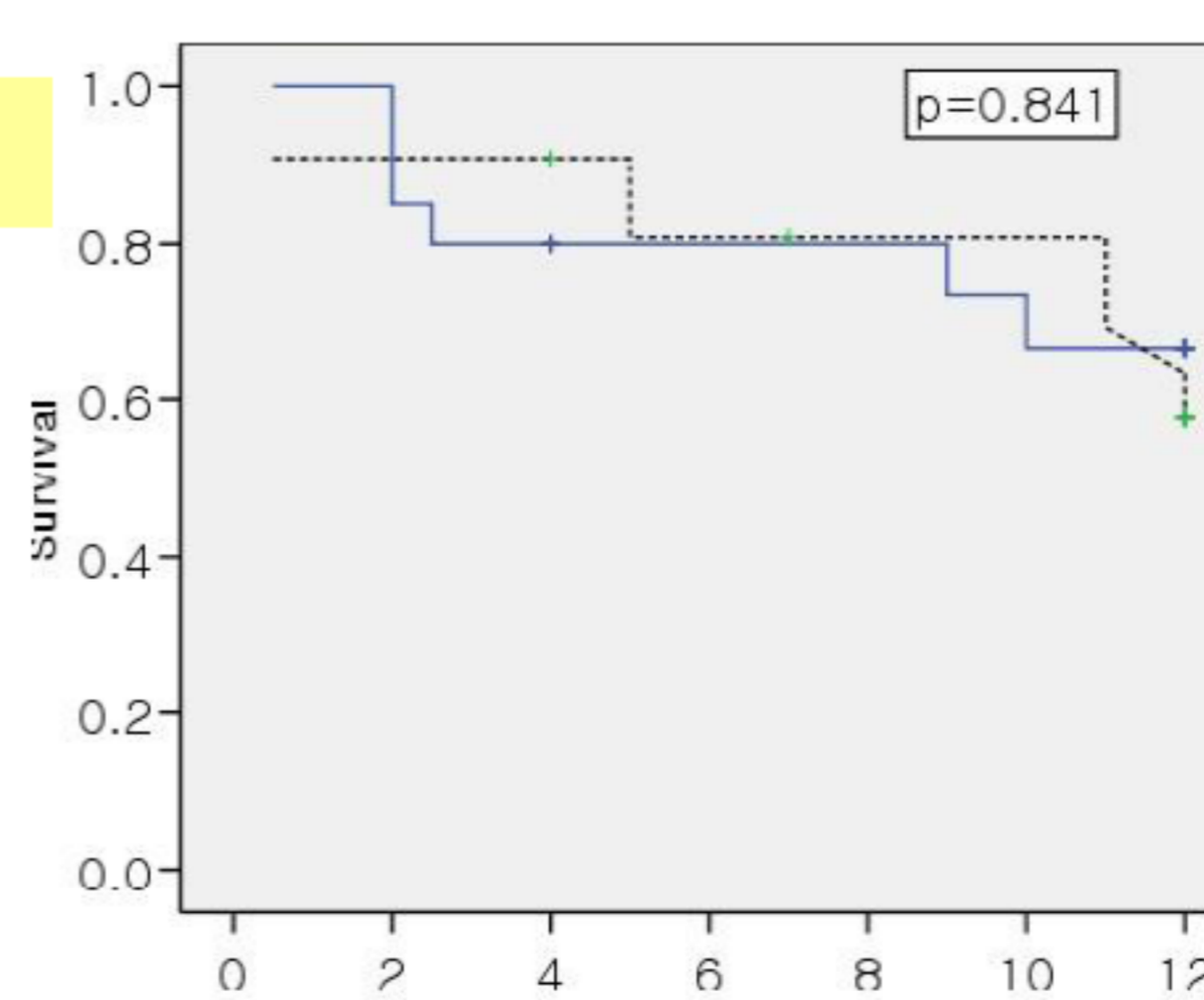


Figure 2. Comparison of Qa changes for 1 year of FIR therapy according to initial Qa (A) and DM (B) in 31 HD patients.

Effect of FIR therapy in access survival



FIR therapy didn't affect access survival in patients with initial Qa <500ml/min and those with initial Qa > 500ml/min.

Figure 3. Effect of FIR therapy on Access Survival according to initial Qa.

Conclusion

FIR tends to improve the access blood flow and improves needling pain in hemodialysis patients. FIR therapy helps to increase access flow in patients with initial Qa <500ml/min and non-DM. Future studies investigating the effect of FIR therapy with large populations and long-term follow-up are needed.