

Original Article

Comparison of Primary Patency and Maturation Rate of Antecubital Arteriovenous Fistula for Dialysis in Diabetic Patient with Two Methods: Regional Block with Ropivacaine 0.5% and Local Anesthesia with Lidocaine 2%

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ABSTRACT

Background: The best arteriovenous access in diabetic patients under dialysis is crucial to attain better therapeutic outcomes and improved prognosis in the patients. The purpose in this study was to compare the primary patency and maturation rate of antecubital arteriovenous fistula for dialysis in diabetic patient with two methods: regional block with Ropivacaine 0.5% and local anesthesia with lidocaine 2%. **Methods and Materials:** In this randomized clinical trial, 40 consecutive diabetic patients under dialysis in 2016 and 2017 in a training center were enrolled and the primary patency and maturation rate of antecubital arteriovenous fistula were compared with regional block with Ropivacaine 0.5% versus local anesthesia with lidocaine 2%. **Results:** The results in this study demonstrated that all factors of final arterial and venous diameter, blood flow, and patency were higher in group under regional block with Ropivacaine 0.5% and all except patency showed significant difference ($P < 0.05$). The complications rates were alike across the groups ($P > 0.05$). **Conclusion:** Totally, according to the obtained results, it may be concluded that regional block with Ropivacaine 0.5% is superior to local anesthesia with lidocaine 2% leading to higher patency rate and shorter maturation time and also higher arteriovenous diameter and blood flow.

INTRODUCTION

Vascular accesses including arteriovenous fistula are common method for dialysis (1-3) especially in patients with end-stage renal disease due to diabetes to improve the survival (4). Increased rate of diabetes and some difficulties in dialysis process is a major concern among vascular surgeons and nephrologists (1,4). The best route for vascular access is a controversial matter in diabetic patients with renal failure (2). Development of a patent long-term route for dialysis in diabetic subjects with renal insufficiency is important for prognosis improvement. One-fourth of hospital admissions in dialysis patients are related to vascular access (2) and the rates of mortality and infection in diabetic cases with catheter insertion are higher than cases fistula use (2). Arteriovenous fistula is preferred method for vascular access in patients under dialysis with longevity and increased wall resistance without adverse effects such as catheter fractures and infections (2).

Vascular catheters care including permanent or transient type is difficult including routine and periodical procedures accompanied with activity limitations. Increased vein di-

ameter and high fistula blood flow rates are important contributing factors for fistula maturation. Anesthetic methods including monitored anesthesia care, regional blocks, and general anesthesia are important issues in vascular access surgeries to attain better vascular diameter and blood flow and subsequent success (4). Primary patency rates are lower among diabetics due to higher rate of background disorders in diabetic patients leading to higher rate of failure and complications (2). Healthy endothelial cells are important to attain optimal venous flow with venous remodeling and those vessels without maturity are not used for dialysis (3).

Innovative methods are crucial to improve the outcomes of dialysis in diabetic methods. Sympathetic block may result in vasodilatation leading to increased blood flow and higher success rate of AVF placement and less thrombosis rate (5). The regional block is the preferred safe method for upper limb vascular surgeries and venodilatation after the block would help to better access (6).

Regional block may be used for development of new arteriovenous fistula with better outcomes in comparison with

local anesthesia because of longer analgesia and shorter immobility length with no significant adverse effects (6). Also it is accompanied with significant increase in fistula blood flow and success rate. It may result in lower vasospasm rate and shorter fistula maturation time and increased success rate (6). Since the vascular disease is more common among diabetic subjects and due to the endothelial cells injuries and released mediators the vascular status in these patients is controversial (3) and determination of effect of axillary block in such patients is important.

Axillary block would develop complete immobility. Diabetic patients due to bad general conditions and cardiovascular diseases are not appropriate candidates for general anesthesia and usually local anesthesia is used for AVF placement to reduce the mobility and related adverse effects. The block would develop optimal results with longer duration especially in patients with obesity and edema. There are few adverse events accompanied with high satisfaction rate with decreased hospital stay and less costs (7).

The best agents for axillary block are those with longer anesthesia duration and appropriate immobility duration (8-16). It would develop permission for upper limb movements that would help to better blood flow in fistula and prevention of thrombosis. We used Ropivacaine as a local anesthetic agent from aminoacides that is accompanied with better effects including motor blockade and immobility during five minutes with faster effects seen after initial preparation with good safety. Regarding some neuropathy side effects the results in them for axillary block is not definitive and the effects on blood flow and maturation rate are controversial.

MATERIALS AND METHODS

In this randomized clinical trial, 40 consecutive diabetic patients under dialysis in 2016 and 2017 in a training center were enrolled. They were candidate for persistent catheter insertion. Data collection was done by medical existing documents and color Doppler ultrasound by the surgeon. Inclusion criteria were diabetes and ESRD in patients that were candidate for permanent access placement for dialysis. Exclusion criteria were hypotension (before/during dialysis), fistula placement history in ante-cubital region, current phlebotomy in ante-cubital region, upper limb plegia/deformity/fracture, coagulopathy and platelet under 50000, vasculitis/peripheral vascular disease, incomplete data, impossibility of follow-up and attendance for ultrasound assessment.

The study was approved by local ethical committee. Patients underwent complete physical examination. At operation room the patients underwent color Doppler ultrasound and the venous and arterial diameters were measured in ante-cubital region. Also the optimal location AVF placement was determined by clinical and ultrasound characteristics. The patients were randomly assigned into two groups; those under axillary regional block with Ropivacaine 0.5% versus patients under local anesthesia with lidocaine 2%. In both groups the venous and arterial diameters were determined and after the operation wound care instructions were mentioned for the patients. Lack of pressure on the fistula region, no phlebotomy or blood pressure measurement from the re-

gion, and some postoperative instructions were trained. In postoperative day patients were examined again for hematoma, thrombosis, bleeding, blood flow, trail, and bruit. After three days and also four weeks the patients were visited and ultrasound assessment was repeated and the primary patency and maturation rates of antecubital arteriovenous fistula were determined. Fistula was considered mature in cases with venous diameter of 6 millimeters with mean distance of 6 millimeters from skin surface and blood flow rate of 600 milliliter per minute. In cases without maturation after four weeks, the patients were followed up weekly up to maturation time.

Data analysis among 40 patients was carried out by SPSS version 24.0 software. The utilized tests included Independent-Sample-T, Chi-Square, and Fisher tests. The P values less than 0.05 were considered statistically significant.

RESULTS

As shown in Table-1 the mean venous diameters were 4.54 and 3.83 mm after procedure in block and lidocaine groups, respectively that showed significant increase in block group. The baseline diameters were same and the median was 3.88 mm. The mean arterial diameter was 3.94 and 4.61 mm in lidocaine and block groups, respectively showing significant difference (P=0.0001).

As demonstrated in Table-2 the blood flow was 607 and 510 milliliter in block and lidocaine groups, respectively with significant difference (P=0.030). Also the maturity duration was 4.2 and 4.65 weeks in block and lidocaine groups that showed significant difference (P=0.046). In lidocaine group, there was three cases of early thrombosis and 14, 2, and 1 patient with maturation after four, five and six weeks, respectively. In block group, there were 1 case of early thrombosis and also 17 and 2 patients had thrombosis after fourth and fifth weeks.

Table 1. Venous and arterial diameters before and after procedure

	Group	Mean	Std. Deviation
Initial Vein Diameter	Intervention	3.8265	.23605
	Control	3.7665	.28768
Final Vein Diameter	Intervention	4.5470	.42425
	Control	3.8365	.29005
Initial Artery Diameter	Intervention	3.8840	.19226
	Control	3.8800	.27106
Final Artery Diameter	Intervention	4.6180	.34560
	Control	3.9470	.27783

Table 2. Blood flow and maturity times across the groups

	Group	Mean	Std. Deviation
Flow	Intervention	607.5000	59.63706
	Control	510.0000	178.26651
Maturity Time (Week)	Intervention	4.20	.410
	Control	4.65	.786

The side effects were not differed across the groups and included three thrombosis cases in lidocaine group and one transient hematoma and one infection cases that were treated with oral antibiotic ($P > 0.05$). Primary patency was seen in 19 cases (95%) and 17 patients (85%) in block and lidocaine groups, respectively without significant difference ($P > 0.05$).

DISCUSSION

In this study it was assessed that if the effects of axillary block on venous dilatation is differed from those of conventional methods in diabetic patients under dialysis that usually have higher rate of neuropathy and vasculopathy. The effects on patency and thrombosis was determined and compared across the groups regarding the matter that primary patency rate in diabetics is lower. It was found that both venous and arterial diameters were significantly higher in block versus lidocaine group leading to higher blood flow in groups under regional block. Totally three cases had early thrombosis in lidocaine group. The mean maturity time was shorter in block group. However the patency rate was same across the groups.

In a study (6) among 41 patients that were candidate for AVF with regional block with a mixture of lidocaine and Ropivacaine via interscalene or infraclavicular methods it was demonstrated that regional block is safe and effective for upper limb vascular surgeries and venodilatation would improve the access placement. In our study also both diameters were increased leading to blood flow increase and successful outcomes in Ropivacaine group. In a review study in United States (7) the factors affecting the AVF success were assessed and significant vasodilation after regional block was seen in both basilica and cephalic veins and use of regional block was recommended to increase the blood flow and success rate of fistula. This matter was approved in our clinical trial.

In a study among 26 patients (8) that were candidate for AVF placement for dialysis with axillary block the average vein diameter was increased and the vasodilatation was established in their study to increase the fistula success rate as well as our study. Another study (9) assessed the efficacy of infraclavicular brachial plexus block and local anesthesia on radial and AVF blood flow in early and delayed phases. They reported further blood flow in block group as seen in our study.

The Egyptian study (10) showed that placement of brachio basilic arteriovenous fistula in patients with inappropriate forearm vessels showed that block would result in further anesthesia duration especially in cases with obesity or edema. Similarly it was relatively safe with high satisfaction rate among patients. In a Polish study (12) among 20 ESRD patients the effects of ultrasound-guided infraclavicular brachial plexus block was demonstrated with Ropivacaine block as shown in our study. The Indian study (16) revealed that Ropivacaine had longer and faster effects versus bupivacaine with further anesthetic effects as well as our study. Among our limitation were cases that were lost to follow-up and lack of competency in all anesthesiologists for axillary

block. Also the ultrasound devices were scarce and the axillary blockage was time-consuming.

Totally, according to the obtained results, it may be concluded that regional block with Ropivacaine 0.5% is superior to local anesthesia with lidocaine 2% leading to higher patency rate and shorter maturation time and also higher arteriovenous diameter and blood flow. Accordingly use of this block method is recommended in diabetic patients with ESRD that were candidate for AVF placement. Further training among anesthesiologists to perform axillary block is recommended. Also preparation for further ultrasound devices in operation room in centers with competency for axillary block is suggested.

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