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The Effects of Axillary Block on Arterial and Venous Diameter and Blood Flow in Arteriovenous Fistula

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ABSTRACT

Brachial plexus block offers several advantages when creating vascular access for hemodialysis. Several studies have demonstrated that brachial plexus block improves arterial and venous diameter and blood flow. This study aims to evaluate the effects of axillary block on arterial and venous diameter as well as blood flow. This was a clinical trial conducted on 40 patients undergoing arteriovenous fistula creation to evaluate the effects of axillary block on arterial and venous diameter as well as blood flow. Ultrasound-guided axillary block was performed. The variables included arterial and venous diameter and blood flow. The pre- and post-intervention values of the values were compared. The mean venous diameter significantly increased from 2.22 ± 0.11 before block to 2.52 ±0.17 after block (P=0.008). Similarly, the mean arterial diameter significantly increased from 3.3 ± 0.17 before block to 3.89 ± 0.19 after block (P=0.001). In addition, the mean pre-block arterial and venous blood flow significantly increased compared to post-block from 37.5 ± 5.1 to 55 ± 7.9 (P=0.001) and 11.1 ± 0.2 to 14.9 ± 1.8 (P=0.001), respectively. Brachial block with axillary approach increases arterial and venous diameters and blood flow and these benefits may be decrease the early failure of arteriovenous fistula.

Key words: Brachial Plexus Block, Arteriovenous Fistula, Arterial Diameter, Venous Diameter, Blood Flow

INTRODUCTION

Patients with renal failure vitally need dialysis. Dialysis can be performed as peritoneal or hemodialysis. Hemodialysis needs a suitable exit blood flow. One of the solutions for this problem is to form arteriovenous fistula with an arteriovenous anastomosis[1]. There are some problems in this process like: limitation in suitable zone for fistula, high rate of failure or inadequate flow for dialysis[2].

To create fistula in upper limb surgery, like brachial plexus block, different protocols are used based on local or general anesthesia. Anesthetic agents would be injected around the plexus[3]. As vessels of upper limbs are enervated by brachial plexus and sympathetic nerves, this block probably reduces the vascular tonicity which consequently dilates arteries and veins and prevents vascular spasm. These modifications help surgeon during operation and may increase the efficacy of fistula[4].

In this clinical trial, we study the effect of brachial plexus block with axillary approach on arterial and venous diameter, blood flow, and efficacy of fistula in the patients need arteriovenous fistula.

MATERIALS AND METHODS

This was a clinical trial conducted on 40 patients referred to Ahvaz Golestan Hospital (Iran) affiliated with the Ahvaz Jundishapur University of Medical Sciences for arteriovenous anastomosis

surgery. Inclusion criteria of the study were End-stage renal disease cases who need arteriovenous fistula, negative past history of surgery on the upper limb, obtaining written consent form all patients, no contraindication for brachial block or local anesthesia was present, no sign of peripheral vascular disease was present, and axillary block was being successful. The exclusion criteria included contraindications of local anesthesia like coagulopathies, injection site infections or anesthetic agent hyper sensitivity, signs of peripheral vascular disease, impossibility of vascular surgery due to morbid veins, and unsuccessful axillary block. At the beginning of experiment, the demographic information of all patients as well as the presence and conditions of background diseases and co-morbidities were recorded.

Following the site placement for anastomosis surgery, the arterial and venous diameter and blood flow were measured using pulsed Doppler ultrasonography technique.

All parameters were measured three times by the same operator and the averaged values were considered for further assessments. Then, brachial plexus block was applied under the guide of ultrasonography using 2 cc of 2% lidocain solution injection with axillary approach.

Then patients were monitored for 15 minutes in supine position at operation room by routine ASA protocol (EKG, pulse oximetry and blood pressure). Nasal oxygen was administered and after a 15 min period, arterial and venous diameters and blood flow were measured again and documented. On the weeks one and four the fistula conditions were followed up by physical examination for any dysfunction including fistula trill and murmur, and blood flow and then the collected data were statistically assessed.

RESULTS

Twenty two male (55%) and 18 female (45%) with the mean age 42 years (35- 58 y) participated in the study. Thirteen patients (32.5%) were diabetic, 21 (52.5%) hypertensive, and 15 (37.5%) had a history of coronary artery disease.

In 21 patients, radial-cephalic fistula was provided and for the remaining (n=19), brachial-cephalic fistula was performed.

The mean arterial diameter before and after block was 3.3 ± 0.17 mm and 3.89 ± 0.19 mm, respectively indicating a statistically significant increase(p=0.001). Similarly, the mean arterial flow before and after block was 37.5 ± 0.51 ml/min and 55 ± 7.9 ml/min, respectively indicating a statistically significant increase (p=0.001).

The mean venous diameter before and after block was 2.22 ± 0.11 mm before and 2.52 ± 0.17 mm, respectively that was statistically significant (p=0.001).

The mean venous flow before and after the block was respectively 11.1 ± 2 ml/min and 14.9 ± 1.8 ml/min showing a significant increase (p=0.001).

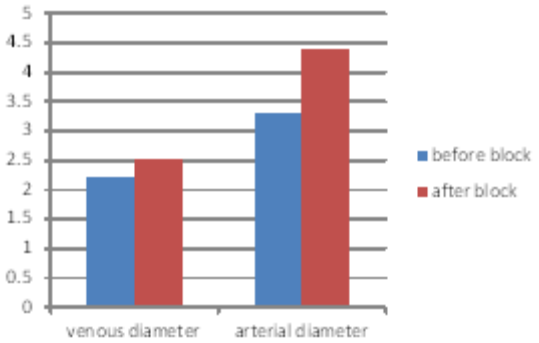

Fig. 1: Comparison of pre- and post block values of arterial and venous diameter

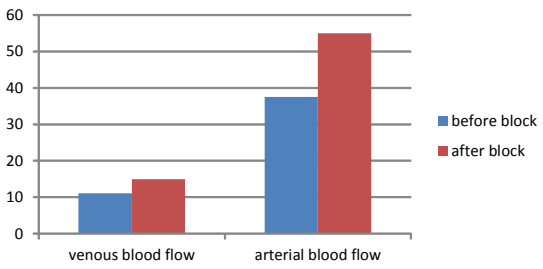

Fig. 2: Comparison of pre- and post block values of arterial and venous blood flow

In the follow-up examinations performed on the 1st and 4th weeks no clinical side effect was observed in the axillary zones.

DISCUSSION

The proper function of fistula depends on normal function of arterial and venous blood flow. The results define significant increase in arterial and venous blood flow due to increased vessels diameter fallowing brachial plexus block.

Decreased diameter blood vessels are common in patients with chronic kidney disease; in other hand, vessels spasm due to increased sympathetic tonicity during the surgery decreases the blood flow and leads to primary thrombosis [5]. The brachial plexus block, focally blocks sympathetic system.

Letipalo *et al* reported decreased sympathetic tonicity, increased skin temperature, and decreased vasoconstriction during brachial plexus block [6]. Blocking sympathetic nerves during the brachial block leads to decrease constriction and increase diameter in vessels same as our results in this study.

Maket *et al* reported significant increase in arterial diameter and blood flow in radial artery as well as in arteriovenous fistula[7]. Although the results are the same as our study, they did not check the venous diameter and blood flow.

In different studies comparing different brachial block techniques, all showed decreased sympathetic tonicity and vessels contraction and have increased vessels diameter and blood flow, and also there was significant increase in fistula blood flow[8, 9].

In the study conducted by Lasuski *et al*, brachial block have led to increase in venous blood flow during the anastomosis operation. They, in accordance with our findings reported significant increase in venous diameter and blood flow after brachial block[10]. In addition, Renold *et al* reported increase in basilica and cephalic vein. Similarly, the Malinzak *et al*.'s study demonstrated increase in venous diameter and blood flow following brachial block[8]. Furthermore, they concluded that using brachial block reduces maturation time of fistula; however, this conclusion needs further studies to be confirmed[8].

Alsalti *et al* reported more cardio-vascular side effects in general anesthesia during anastomosis operation that local anesthesia[4] indicating that brachial block beside the increase in blood flow in the fistula and the improve in operation success has lesser systemic side effects. In another study by Ildrom *et al*, they blocked stellar sympathetic ganglia for 7 days and saw there was increase in upper limb arterial blood flow and it increased fistula flow and decreased fistula maturation time[11]. In conclusion, further studies are needed to compare efficiency of brachial block and sympathetic ganglion block. Findings of this study can be used to develop new efficient non-pharmacological techniques for the treatment of metabolism related dysfunctions[12-14].

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