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Intravenous Regional Anesthesia (Bier Block) Method for Arteriovenous Fistula creation in patients with End Stage Renal Disease

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Abstract

Introduction: Hemodialysis through creation of arteriovenous fistula (AVF) is an established surgical procedure for patients with End Stage Renal Disease (ESRD). Anesthetic methods management for this surgery should deal with different risk factors such as hypertension, ischemic heart disease and diabetes. Intravenous Regional Anesthesia (IVRA) or Bier block anesthesia as an option for AVF creation has reportedly been attributed to some advantages over other techniques in AVF creation. The present study aims to evaluate the efficacy of Bier block in AVF creation and compare its efficacy with local anesthesia.

Methods: The subjects of the study were the pa ents (n=60, aged 20-65 years), who had been admi ed for an AVF creation. The patients were divided into two randomly assigned matched groups: Local Anesthesia (LA) group and Intravenous Regional Anesthesia (IVRA) group.

Results: The patients' satisfaction levels, simplicity and feasibility of the procedure in the IVRA group were higher, compared to the LA group (94.1%, 66.7%, and 4.85% vs. 82.8%, 51.7% and 3.5%, respectively). However, these differences were not statistically significant.

Conclusions: The two main advantages of Bier block technique are the simplicity of operation and provision of a bloodless field for surgeon. It provides maximum dilatation in veins through the injection of the anesthetic drug and placing a tourniquet on it.

Key Words: Bier block; AVF creation; hemodialysis; local anesthesia

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Introduction

Surgival approaches for hemodialysis in end stage renal disease patients have done from 1960. Many approaches have proposed for creating access and more patency for patients. Prevalence of patients who need more patency access is increasing. Recent advances in medical treatment and patient care have dramatically increased life expectancy of patients with End Stage Renal Disease (ESRD). Hemodialysis through creation of arteriovenous fistulocal anesthesia (AVF) is an established surgical procedure for patients with ESRD [1]**.** Anesthetic options for AVF surgery include general anesthesia, regional anesthesia and local anesthetic infiltration at the site of surgery. All of anesthetic managements for AVF surgery should deal with different risk factors such as hypertension, ischemic heart disease, diabetes, chronic pulmonary disease etc.

Intravenous regional anesthesia was the first technique which applied by Bier on 1908.The most common anesthetic technique for AVF creation is local techniques [2] which are performed by administration of 3 mg/kg dose of 1% lidocaine solution [3]. However, local anesthetic techniques are accompanied by deep injection that is painful. General anesthesia has been considered as a good technique in AVF creation, especially for children as they do not cooperate well with the procedure and in cases that it is preferred by the patients and surgeon [2]. Regional anesthesia, including brachial plexus block (BPB) and Bier block, is another anesthetic option for AVF creation. Brachial plexus block is an old method which is generally used for surgeries on upper extremity. This technique involves the injection of local anesthetic agents in close proximity to the brachial plexus, temporarily blocking the sensation of the upper extremity There are some disadvantages associated with BPB such as low success rate of anesthesia and high risk of intra-arterial injection [3].

Intra-Venous Regional Anesthesia (Bier block), was described for the first time by Bier (1908) as a simple anesthetic method in distal arm or leg [2, 4]. It is indicated in any surgery on forearm [3-5]. The onset of anesthesia from the administration is about 5 minutes which local anesthesiasts about 1.5-2 hours [3, 6]. Notwithstanding its rapid onset, vasodilocal anesthesiatation [7], and acceptable muscle relocal anesthesiaxation, Intra Venous Regional Anesthesia cannot be safely used in patients with severe Reynaud's, sickle cell disease, with limb crush injuries and in patients with history of hypoxic tissues [6]. The most important Intra Venous Regional Anesthesia 's complications are caused by local anesthetic toxicity when the cuff is deflocal anesthesiated too soon after the drug injection [7]. Intravenous Regional Anesthesia (Intravenous Regional Anesthesia) or Bier block anesthesia as an option for AVF creation has reportedly been attributed to some advantages over other techniques in AVF creation. The present study aims to evaluate the efficacy of Bier block in AVF creation and compare its efficacy with local anesthesia.

Methods

In this clinical trial study, the efficacy of Local Anesthesia and Intravenous Regional Anesthesia in AVF creation was evaluated and compared. During nine months of this project, Bier block or Local anesthesia was performed on 60 patients (aged 20-65 years old) who were admitted for the first time for the creation of Arterial-Venous Fistulocal anesthesia and in primary evaluation they had a suitable superficial vein (cephalic vein). The indication of creating a vasculocal anesthesiar access and lifelong need for hemodialysis were confirmed as an end stage renal disease by nephrologists and all cases were carried out by one vasculocal anesthesiar surgeon.

The patients with a systolic blood pressure equal or less than 100 mmHg and those suffering from congestive heart failure were excluded from this study group.

The cases were randomly divided into two different groups based on their anesthetic technique. A questionnaire which contained patient's personal information, procedure type, and its three-month follow-up outcomes, was filled by each patient. Standard monitoring including noninvasive blood pressure monitoring, pulse oxymetery and electro cardiogram has plocal anesthesiaced for both groups. All procedures have done in supine position. The patients' satisfaction, level of being painless during the procedure (based on 0-10 Numeric Pain Scale), the site of operation, and its early and local anesthesiate complications were evaluated as well. These data were compared between the local anesthesia and Intra Venous Regional Anesthesia groups.

This protocol procedure was approved by the Research Ethics' Committee of Mashhad University of Medical Sciences (MUMS). Statistical analyses were performed using SPSS Software (Version 11.5). Data were expressed as Mean and Standard deviation. Paired t-test and man-whietney wilcakson and fischer exam was applied to

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demonstrate statistical differences between the two methods. The significance level of 0.05 was set for all statistical analyses.Variables that evaluated included age.sex,co-existing diseases,location of operation,feseability of operation,early and local anesthesiate complications,patient satisfaction and duration of surgery.

Results

This study has begun on 60 patients. During the follow-up period ten patients (1 in INTRA VENOUS REGIONAL ANESTHESIA and 9 in local anesthesia group) were excluded from the study, because of transplocal anesthesiantation, inaccessibility, or death of the patient. Then study has continued in 21 patients in Intra Venous Regional Anesthesia group and 29 cases in local anesthesia group. There were no significant differences between groups about age and sex. Incidence of comorbidities has shown in ure 1. Average of preoperative systolic blood pressure and characters of operation such as site of operation,artery and venous diameter and anstomosis length was the same in two groups (Table 1).

In Intra venous regional anesthesia group hypertension and combination of hypertension and diabetes mellitus was 46.7% and 53.3% respectively. In local anesthesia group hypertension and combination of hypertension and diabetes mellitus was 62.9% and 26.9% respectively and seven patients

Table 1: comparing Intra Venous Regional Anesthesia (IVRG) and Local Anesthesia (LA)

Comparing the results of each variable		Intra Venous Regional Anesthesia (IVRG)	Local Anesthesia (LA)	P-Value
Sex (%) (Male/female)		71.4 / 28.6	69 / 31	0.85
Age (mean±SD)		53.25±19.81	47.65±16.83	0.29
Feasibility (%): Simple /Moderate/ Tough		66.7 / 28.5 / 4.8	51.7 / 44.8 / 3.5	0.26
Outcome (%): Good/ Non-functional		90 / 10	93 / 7	0.17
Outcome 3 m. f/u		Good	Good	
Site (%)	Wrist	19	7.1	0.23
	Snuff Box	33.3	57.1	
	Forearm	38.1	11.4	
	Cubital	9.5	14.3	
Left/Right		80 / 20	85.7 / 14.3	0.6
Arterial diameter (mm)		2.31±0.52	2.58±1.13	0.30
Venous Diameter (mm)		2.40±0.64	2.54±0.71	0.46
Anastomosis Length (mm)		2.40±0.64	2.54±0.71	0.77
Operation time (min.)		28.71±11.96	33.96±11.71	0.12
Patient Satisfaction Level (painlessness) P=0.27		94.1%	82.8%	0.27

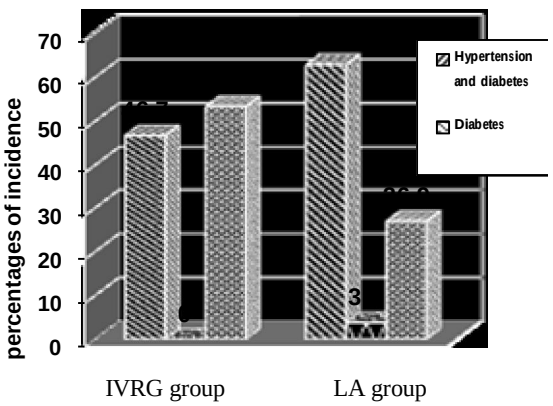

Figure 1: Incidence of comorbidities

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had isolocal anesthesiated diabetes (3.8%). Some patients hadn't establish certain underlying disease in their records. Precise Fischer test showed no significant differences between two groups about co-existing disease.

The surgeon reported incidence of easy operations in Intra venous regional anesthesia group was more than Local anesthesia group (66.7% vs 51.7% respectively), but it wasn't significant differences statistically. Apropriate early and local anesthesiate (three month follow–up) outcomes including good function of fistulocal anesthesia was more than 90.0% in both groups. Although average duration of operation in Intra Venous Regional Anesthesia group was 5 minutes lesser than local anesthesia group (28 vs 33 minutes respectively) it wasn't significant statistically. Patients satisfaction was the same in two groups. There was no significant differences about results of surgery quality. In Intra Venous Regional Anesthesia group surgery quality (good,week and no functional) was 81%,12.3% and4.8% respectively. In other group surgery quality was 96.6% good, 3.4% week and all fistulocal anesthesias were functional. In Intra Venous Regional Anesthesia group the most used site of operation was the arm (8 patients, 38.1%), but in local anesthesia group there was snuff box (16 cases, 51.7%). Precise fischer test showed no significant differences between two groups about site of operation (p=0.238).In Intra Venous Regional Anesthesia group surgery has done in left and right side, 16 (80%) and 4 cases (20%) respectively. In local anesthesia group it was 24 and 4 cases, (85.7) and 14.3%) respectively. There was no significant differences between two groups about side of operation (P=0.600). In INTRA VENOUS REGIONAL ANESTHESIA diameter of artery was 2.31+/-.52and it was in other group 2.58+/-1.13.T test didn't show significant differences about this matter (P=0.307).We evaluated arterial diameter ,In subgroup 1 arterial diameter was less than 2 millimeter in cubital or arm region, and less than 1.5 millimeter in snuff box and wrist region. In subgroup 2 arterial diameter was 2 to 4 millimeter in cubital or arm region, and 1.5 to 2.5 millimeter in snuff box and wrist region. In subgroup 3 arterial diameter was more than 4 millimeter in cubital or arm region, and more than 2.5 millimeter in snuff box and wrist region. Incidence of cases in mentioned subgroups was the same In Intra Venous Regional Anesthesia and local Anesthesia group (P=.669).

Discussion

There are various impacts of anesthetic procedure on the AVF success rate [8]. General anesthesia has been considered as a good technique of anesthesia in AVF creation; nevertheless, it almost always causes a decline in blood pressure and cardiac output. This phenomenon by depressing the fistulocal anesthesia flow rate may negatively influence the success rate of AVF creation [4]. Regional anesthesia that includes brachial plexus block and Intra Venous Regional Anesthesia were shown to be safe and effective anesthetic methods. Therefore, it is a preferred anesthesia technique anesthesia for upper extremity of vasculocal anesthesiar surgery [9-13]. 7 cases with death had reported between 1979 to 1983 following intra venous regional anesthesia in Britain. all of these cases have done by surgeon and drog used was bupivacaeine,then it is possible that there is relocal anesthesiation between bupivacaeine and cardiac arrest [6]. Some other complications has reported such as transient drowsiness, tinnitus, convultion and reduce of alertness. Local anesthesiate signs of toxication aren't current. Some other complications refers to cardiovasculocal anesthesiar toxicity of intra venous block drugs. These side effects include atrioventriculocal anesthesiar block, bradyarhythmias and even cardiac arrest. Other complications are relocal anesthesiated to tornique use. Long duration of tornique inflocal anesthesiation may prone the limb to hypoperfusion which followes by ischemia and pain in the limb. Incidence of nerve damage is 1:8000. Brachial plexus block or local anesthesia in vasculocal anesthesiar surgery does not provide a neat and bloodless field with dilocal anesthesiated veins comparing Intra Venous Regional Anesthesia. Furthermore, anesthetic period is longer in local anesthesia than the Intra Venous Regional Anesthesia anesthetic [14]. The success rate of a complete brachial plexus block achieved in other studies implemented in better medical care centers, has been reported up to 83% [7].

Intra Venous Regional Anesthesia or Bier block is a simple method which offers the surgeon sufficient time, a clear filed, and a vein with increased internal diameter. Considering the 90% success rate of Intra Venous Regional Anesthesia in our study, it also could be used in other fields of surgeries, especially in those dealing with upper limbs.

The patients' satisfaction level, simplicity and feasibility of the procedure were higher in the Intra

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Venous Regional Anesthesia group compared to the local Anesthesia group (94.1%, 66.7 and 4.8 vs. 82.8%, 51.7 and 3.5, respectively). However, these differences were not statistically significant (P>0.05).

Possible complications of Intra Venous Regional Anesthesia include pain induction at the site of tourniquet, operation time limit and systemic complication after deflocal anesthesiation due to the anaesthetic and metabolites' flow from the limb to the systemic circulocal anesthesiation, which did not luckily occur in our cases.

Conclusions

In short, regarding advantages of Bier's block anesthesia method addressed in our study such as bloodless field, vasodilatation, high feasibility rate, satisfaction of the surgeon, and low complication, it is a recommended for AVF creation.

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