

Influence of the Type Of Anesthesia On The Rate Of Maturation Of Arteriovenous Fistulas In Patients On Hemodialysis Protocol

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KEYWORDS

Anesthesia, brachial plexus block, maturation, arteriovenous fistula.

ABSTRACT

This article aims to determine if the type of anesthesia influences the maturation rate of arteriovenous fistulas (AVF) in patients on hemodialysis protocol.

To this end, an observational, retrospective study was carried out from the clinical records of patients who underwent AVF in the period December 2021-June 2022 at the ISSSTE Tláhuac Hospital. Information of interest was obtained from the records, including age, sex, anthropometric characteristics, comorbidities, anesthetic risk, type of anesthesia (BPB: brachial plexus block versus general anesthesia), fistula maturation, and complications. Descriptive and inferential statistical analysis was performed. A cutoff value of $p \leq 0.05$ was considered significant.

45 patients with a mean age of 54.8 ± 10.6 years were included. At three weeks post-fistula formation, the AVF maturation rate was 84.4%. At 6 months of follow-up, 97.8% of the fistulas were functional. Steal syndrome was the only complication and was found in 6.7% of patients. The Odds Ratio (OR) for fistula maturation in patients who underwent BPB was 8.1, 95%CI 1.3-48.8 ($p=0.023$).

It can be concluded that the BPB is associated with a higher rate of AVF maturation for hemodialysis.

1. Introduction

Chronic kidney disease (CKD) is defined as the presence of kidney damage or a glomerular filtration rate (GFR) $<60\text{mL/min/1.73mt}^2$, albuminuria $>30\text{mg}$ in 24 hours, with or without markers of kidney damage that persist for more than 3 months, regardless of the cause. Driving finally to the need for renal replacement therapy through dialysis or transplantation. (1, 2)

Haemodialysis is the preferred form of replacement for renal function whenever possible, due to its increased patency, low rates of thrombosis, infection, hospitalisation and mortality. It can be performed by three vascular access modalities: 1) central venous catheter, 2) arteriovenous graft, and 3) autologous arteriovenous fistula (AVF). (3)

It is recommended to create access by AVF at least 6 months prior to the start of hemodialysis to ensure the maturation of the vein, its evaluation and, if necessary, improve conditions (4, 5). Variable success rates of vascular access by AVF have been reported, and there is significant concern about the time required to achieve vascular access maturation, because delays in maturation may occur, which postpone the initiation of treatment (6).

The type of anesthesia may be a factor associated with long-term AVF maturation, because regional anesthesia produces a sympathetic nerve block that results in increased intraoperative venous diameter, and for several hours postoperatively, maintaining adequate blood flow through the fistula that could favor its maturation. However, there is still limited information on the impact of regional anaesthesia on vascular access outcomes (failure rates, patency and complications), as well as the comparison of these outcomes with those of general anaesthesia (7). Therefore, in this study we evaluated whether the type of anesthesia influences the rate of AVF maturation in patients on hemodialysis protocol.

2. Methodology

Prior to its completion, this study was submitted for approval by the Research and Bioethics Committees of the ISSSTE Tláhuac Hospital.

This study is observational, cross-sectional, analytical, retrospective; patients with stage IV CKD were included in it, according to the KDOQI criteria, i.e. with GFR <30 ml/min/1.73m²). These patients underwent AVF at the ISSSTE Tláhuac Hospital in the period December 2021-June 2022.

Given that the follow-up of patients undergoing AVF for hemodialysis in our hospital is precise and careful, the following information of interest was obtained from the records: age, sex, anthropometric characteristics, comorbidities, anesthetic risk, type of anesthesia used, fistula characteristics, and complications.

Statistical analysis was performed with descriptive tests such as mean and standard deviation for quantitative variables, and with frequencies and percentages for qualitative variables.

The maturation rate of AVFs was estimated as a percentage of the total number of procedures performed; while to identify the factors associated with fistula maturation, Odds Ratios (ORs) were estimated with their 95% confidence interval (CI). The ultrasound criteria for considering mature AVFs at 3 weeks were a fistula diameter greater than or equal to 6 mm and/or a fistula flow greater than or equal to 500 mL/minute.

The Chi-square test and the Student's t-test were used as inferential statistical tests. A value of $p < 0.05$ was considered significant.

3. Result and Discussion

A total of 45 patients with a mean age of 54.8 ± 10.6 years were included, of which 80% were male and 20% female. All patients had arterial hypertension, 75.6% had diabetes mellitus, and 73.3% had dyslipidemia. In addition, 73.3% were smokers. Mean BMI, weight, and height are presented in Table 1.

In relation to the anesthetic-surgical characteristics of patients undergoing AVFs, the predominant ASA anesthetic risk was grade III (82.2%), the predominant Caprini thromboembolic risk was high and moderate (86.7% between the two), the most common anesthetic technique was regional with brachial plexus block (BPB) (68.9%), and the mean duration of the procedure was 151.1 ± 37.2 minutes [Table 2].

At three weeks post-fistula formation, the maturation rate was 84.4%. While, at 6 months of follow-up, 97.8% were functional. In relation to complications, only theft syndrome was identified, which was found in 6.7% of patients [Table 3].

To determine the factors associated with fistula maturation at 3 weeks, the characteristics of patients with and without AVF maturation were compared. In patients with mature fistulas, the most common type of anesthesia was BPB (76.3%), and in patients without AVF maturation, the most common anesthesia was balanced general anesthesia (71.4%) [$p = 0.023$]. No significant differences were found in other characteristics between patients with and without mature fistulas [Table 4].

In addition, BPB was also associated with AVF maturation with an OR: 8.1, 95% CI 1.3- 48.8 ($p = 0.023$, Fisher's exact).

DISCUSSION

Since the efficacy of dialysis treatment depends on the functional status of the vascular access, it is desirable to achieve the installation of optimal access to directly affect the results of hemodialysis. Therefore, in this study, we evaluated whether the type of anesthesia influences the rate of maturation of AVFs. Below, we analyze the results of this study.

First, the maturation rate of the AVF at 3 weeks after its performance was 84.4% and at 6 months of follow-up, more than 97% of the fistulas were functional. This success rate in AVF maturation is high given that recent reports have reported successful maturation rates of arteriovenous fistulas ranging from 40% to 80%. Other reports indicate a success rate of 65% after starting hemodialysis. Therefore, the maturation rate of AVFs at 3 weeks in our patients is among the highs reported in the literature. (

8 , 9) (1 0)

Second, the literature reports several factors that influence the functional maturation of AVFs including age, sex, some blood biomarkers, and preoperative, intraoperative, and postoperative factors. However, these factors in our study were not associated with AVF maturation. (8 , 9)

BPB was associated with a higher probability of AVF maturation at 3 weeks, which is noteworthy because this was the main factor we wanted to analyze if it was associated with AVF maturation. In fact, in a previous clinical trial, BPB significantly improved primary patency rates of AVF at 3 months compared to local anesthesia. Similarly, in another study, BPB was found to improve the ripening rate and patency of AVFs. Therefore, there is growing evidence of better maturation of AVFs with the use of BPB than with general anesthesia, so the use of BPB for the creation of AVF would be preferable whenever possible. This is plausible because this form of anesthesia produces significant venous dilation that lasts for several weeks and improves the patency of the AVF (1 1) (1 2) by maintaining adequate blood flow through the fistula (1 3).

Finally, the only complication that occurred in patients who had AVF was steal syndrome, which occurred in 6.7% of them. Steal syndrome is caused by a decrease in distal arterial perfusion due to an outflow preference of proximal arterial flow through the drainage vein, decreasing distal arterial perfusion pressure. This complication has been reported in up to 73% of AVFs and is considered a physiological phenomenon that gives symptoms in about 8% of the attacks. Therefore, the frequency of this complication in our patients is lower than previously reported and did not cause major problems. (1 4)

Although this study is single-center and includes a modest sample size, it allowed us to identify a couple of factors associated with fistula maturation that should be considered when planning anesthesia and AVF formation.

4. Conclusion and future scope

The rate of AVF maturation and functionality was high among our patients, and higher than that reported in other studies. The use of BPB instead of balanced general anaesthesia was associated with a higher rate of fistula maturation. In this way, we recommend the use of BPB to improve the ripening rate and functionality of the AVF.

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