Evaluation of Patency of Arteriovenous Fistula and Its Relative Complications in Diabetic Patients

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Purpose: To study the arteriovenous fistula patency, duration of its maintenance, and its relative complications.

Materials and Methods: One hundred and thirty patients who had undergone hemodialysis during five years (1996 to 2001) were included in this study. The patency rate and complications, including paresthesia, pain induced by ischemia, venous hypertension, infection, erythema, and edema, were assessed. Data were recorded in the pre-designed questionnaire and statistically analyzed using *t* test.

Results: Mean ± standard deviation age of the patients was 58.08 ± 11.73 years (range, 18 to 80 years). Most of the fistulas were created at the left bracheocephalic (58 subjects). Side-to-side technique was the mostly applied technique (99.2%). The fistula patency was 100%, 92.64%, 89.48%, 84.38%, and 83.61% at year 1 to 5, respectively. There was a significant negative correlation between the subjects' age and maintained patency ($P = .02$). However, no significant difference was observed between the maintained patency and other variables, including gender, location of the fistula, and the type of the technique applied for creation of the fistula ($P > .05$).

Conclusion: Diabetes does not have a negative impact on the rate of patency and its duration in arteriovenous fistula. However, further investigations on a larger population are recommended.

Keywords: diabetes mellitus type 2, arteriovenous fistula, hemodialysis

INTRODUCTION

Diabetes type 2 is characterized by chronic hyperglycemia and abnormal carbohydrates, fat, and protein metabolism, which are due to either lack of insulin production or failure of its performance at the level of cells. The prevalence of diabetes has globally increased during the last two decades. The reported prevalence is 0.19% in people under 20 years of age and 8.6% in adults over the age of 20.[1,2]

Fasting hyperglycemia and impaired glucose tolerance are responsible for short and long-term complications that affect all the body systems.[3] One of the important complications of diabetes is renal failure. Hemodialysis is the most common treatment modality by the means of arteriovenous fistula (AVF). Although hemodialysis was initially introduced by Kolf and colleagues in 1943, its routine application was delayed until 1960 because of the need for permanent access to vascular network in prolonged hemodialysis.[4,5] Endogenous AVF was introduced by Brescia and associates in 1966.[6] Therefore, supply of the synthetic vascular implants in patients with impaired peripheral venous network facilitated hemodialysis.[7]

However, vascular access failure remains a significant problem in hemodialysis. When the fistula is established, its relative complications are the most important cause of hospitalization and death. This increases the cost of treatment in patients with end-stage renal disease.[8] The ideal vascular access creates an appropriate flow for hemodialysis. Furthermore, it stays functional for a long period of time with minimal complications.[8,9]

The AVF has a high complication rate and its patency plays an important role in the treatment. Therefore, we decided to conduct a retrospective study to evaluate the AVF patency, determine the duration of its maintenance, and to study its complications in diabetic patients who had undergone hemodialysis during five years, from 1996 to 2001.

MATERIALS AND METHODS

This retrospective study was conducted on diabetic patients who suffered from chronic renal failure. Subjects with the creation of AVF to perform hemodialysis were included in the study. Patients entered the study after a written informed consent was obtained from each of them. Subjects were excluded from the study if they died due to reasons unrelated to the disease or fistula, or had kidney transplant less than a year following the creation of the fistula. However, the number of missing patients was negligible.

All the procedures were performed by the same surgeon. No drug was administered to improve the function of the fistula in the patients. Telephone follow-up in addition to clinical examination of the patients were performed considering the patency and the frequency of complications, such as paresthesia, pain induced by ischemia, venous hypertension, infection, erythema, and edema. Data were collected during 6 months and were recorded in a pre-designed questionnaire.

Eventually, 130 patients remained for statistical analysis. Data were analyzed with SPSS software (the Statistical Package for the Social Sciences, Version 9.0, SPSS Inc, Chicago, Illinois, USA) using *t* test. The Spearman's rank correlation coefficient was also used to evaluate the correlation between subjects' age and duration of patency of the fistula. *P* values less than .05 were considered significant.

Table 1. Location of the fistula and duration of patency.

Location of the fistula	Number (%)	Duration of patency (mean ± standard deviation), month
Brachiocephalic		
Left	44.6 (58%)	25.27 ± 15.77
Right	16.2 (21%)	24.0 ± 13.76
Radiocephalic		
Left	0.8 (1%)	17
Right	3.8 (5%)	15.2 ± 6.68
Anatomical snuffbox area		
Left	29.1 (38%)	24.18 ± 18.12
Right	5.4 (7%)	25.27 ± 15.77

RESULTS

Mean ± standard deviation age of the patients was 58.08 ± 11.73 years (range, 18 to 80 years), and half of the subjects were men. Most of the fistulas were created at the left brachiocephalic (58 subjects). The most common applied technique for creation of the fistula was side-to-side technique (99.2%). Location of the fistula and duration of patency are presented in Table 1.

Of 130 patients, 123 (94.6%) did not experience any post-

Table 2. Duration of patency in different genders and number of complications in patients.

Variable	Number	Duration of patency (mean ± standard deviation)
Gender		
Male	65	23.64 ± 15.33
Female	65	24.83 ± 16.34
Complication		
Yes	7	19.85 ± 13.6
No	123	24.48 ± 15.92

Table 3. Rate of complications in different genders and location of the fistula.

Variable	Rate of complication, %
Gender	
Male	6.2
Female	4.7
Location of fistula	
Brachiocephalic	7.7
Radiocephalic	16.7

operative complication. The fistula patency was maintained 100%, 92.64%, 89.48%, 84.38%, and 83.61% from year 1 to 5, respectively. No significant difference was observed between the patency and variables, including gender, location of the fistula, and the type of the technique applied for creation of the fistula ($P > .05$; Tables 2 and 3). There was a significant negative correlation between the subjects' age and the patency. The duration of the fistula patency decreased when the age of the subject increased ($P = .02$).

DISCUSSION

In the present study, there was a significant correlation between age and duration of the fistula patency. However, no correlation was found between the age of the patients and the frequency of the complications. This finding disagrees with Windus's findings. He reported that the patients' age affects the patency of the AVF. He strongly suggested that fistula complications are multifactorial.[10] The rate of the complications in the present study was low and not affected by the age of the patients. Lin and associates also showed that patient's age could not affect the complication associated with the AVF,[11] which is in agreement with our findings.

The patency in this study was 100% and 83.61% in the 1st and 5th years of the study, respectively. This was shown to be between 60% and 70% for three years in the previous studies.[12,13] Sesso and coworkers studied 295 patients undergoing hemodialysis, of whom 71 patients were diabetic, who had less duration of fistula patency. After one year, they reported survival rate of 67% for diabetic patients.[12]

Of the 106 patients studied by Tuka in 2006, 48 were diabetic. Higher wall shear rate in the feeding artery was reported with diabetes mellitus and distal vascular access creation. This could be of relevance in the pathogenesis of access complications and thus, lower patency rates in diabetic patients.[13] Resic and colleagues conducted a study on 40 patients undergoing hemodialysis, of whom 30% were diabetic. Predictors of AVF malfunction in their study were age, diabetes, and being overweight, while other clinical and demographical factors did not influence AVF adequacy.[14]

In general, review of the literature shows controversy regarding the effect of diabetes on the duration of the fistula patency and complications associated with AVF. For instance, Lin and associates and Murphy and Nicholson did not observe a significant difference in duration of vascular patency among diabetic and non-diabetic patients.[11,15] But as mentioned above, Sesso, Tuka, and Resic reported less duration of the fistula patency in diabetic patients compared to non-diabetics.[12-14]

Ernandez and associates indicated that gender of the patients as well as surgeon's experience is of primary importance to avoid early AVF failure occurrence.[16] This is not inconsistent with the results obtained in the present study. Unfortunately, due to lack of accurate statistics, inadequate numbers of the studies, and different applied methods in determining the duration of fistula patency, providing the exact comparative evaluation among the results is difficult and complicated.

CONCLUSION

Diabetes does not have a negative influence on the rate of patency and its duration in AVF. However, further investigations on larger population are recommended.

CONFLICT OF INTEREST

None declared.

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