

Outcome of Autogenous Arteriovenous Fistula for Hemodialysis in Elderly Patients with End Stage Renal Disease

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Abstract

Objective: To study functional outcomes, in terms of 1-, 3-, 5-year patency rate and post-operative complications in patients with end-stage renal disease (ESRD) who underwent autogenous arteriovenous fistulas for hemodialysis and to compare the outcomes in patients aged over 60 years and those of patients age under 60 years.

Materials and Methods: All records of the patients who underwent autogenous arteriovenous fistula between January 2003 and June 2007 were reviewed. The patency rates and complications were analyzed in both groups. The statistic analysis included chi-square test, independent samples t-test, Fisher's exact test, Kaplan-Meier survival analysis with log rank test comparison and Cox regression analysis.

Results: From 343 patients, 217 patients met the inclusion criteria. All were divided into two groups according to the age group. Group 1 (age over 60 years) consisted of 112 patients and Group 2 (age under 60 years) consisted of 105 patients. There were no differences in terms of gender, co-morbid diseases, type of arteriovenous fistula and biochemical data before operation but only differences in duration of ESRD before operation ($p = 0.028$). The patency rates at 1, 3 and 5 years were 76.8%, 54.5% and 48.2% for patients aged over 60 and 81%, 65.2% and 53.3% for patients aged under 60, respectively. There were no significant differences in patency rate for AVF between both groups (p -value = 0.387). In age over 60 years group, gender and type of fistula were not significant differences in patency but diabetes was significant differences in patency ($p = 0.001$). There were no significant differences in complication between both groups. Multivariate analysis demonstrated significant correlation between the patency loss and these variables: diabetes (HR = 2.837; 95%CI = 1.912-4.208, $p < 0.001$), active bleeding or hematoma at surgical site (HR = 4.281; 95%CI = 1.328-13.795, $p = 0.015$) and surgical site infection (HR = 8.642; 95%CI = 3.079-24.255, $p < 0.001$).

Conclusion: Autogenous arteriovenous fistula is the first angioaccess for hemodialysis also in older patients. Survival of the autogenous arteriovenous fistula is independent of age. There is no difference in autogenous arteriovenous fistula complications across age groups. Diabetes were related to patency loss in older patients.

Key words: arteriovenous fistula, diabetes, end stage renal disease, hemodialysis

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INTRODUCTION

In Thailand, elderly patients are becoming the majority of patients who need regular hemodialysis. Elderly patients usually have co-morbid diseases beside the problem of renal insufficiency. Despite a considerably lower survival rate and increased hospital utilization as compared with younger patients, elderly patients tolerate dialysis therapy well and appear satisfied with their lives and show increased anticipation for hemodialysis. Just a few decades ago, persons aged over 60 years suffered from hemodialysis program because of limited financial resources and unavailability of dialysis machines.¹ Now this striking rise in the number of elderly persons undergoing dialysis is not only the result of increased availability of financial and technological resources, but also the change in physician's willingness to offer such treatment to high risk individuals. The diagnosis of renal failure is frequently over-looked in older individuals as many of whom may have required little medical care during their early years. Some older patients may not be readily referred for evaluation of renal failure due to family and physician's reluctance. Elderly individuals who gain access to the ESRD system are given the same treatment options as the younger counterparts. Choice of dialysis is influenced by nephrologists and caregivers' recommendations. Although both hemo- and peritoneal dialysis are considered excellent forms of therapy for old persons, most patients simply choose the former because it is more convenient and they feel safer to have trained staff performing their treatments. Létourneau et al² showed that the elderly were more frequently treated by hemodialysis than peritoneal dialysis (81 vs 19%) compared with the younger counterparts (65 vs 35%).

Vascular access is an important step for patients awaiting renal replacement therapy. Autogenous arteriovenous fistula (AVF) is the most preferable type of vascular access. However, the presence of arteriosclerotic vessels and inadequate forearm veins in elderly patient may preclude satisfactory development of arteriovenous fistula. Advanced age as well as the rapid increase in underlying diseases such as diabetic mellitus and atherosclerosis also means that the veins and arteries used to establish autogenous AVF have had vascular damage. These make construction of an AVF more difficult. Older patient are particularly prone to develop post-operative ischemia

because of preexisting atherosclerosis.

The National Kidney Foundation Kidney Disease Outcomes Quality Initiative³ (NKF KDOQI) clinical practice guideline recommends autogenous AVF as the most appropriate hemodialysis access. The NKF KDOQI practice guideline states in order of preference for vascular access as (1) radial artery-cephalic vein AVF at the wrist; (2) brachial artery-cephalic vein AVF at the upper arm; (3) transposed brachial artery-basilic vein AVF and (4) arterial-venous graft. Successful AVFs are not feasible in many patients. Several reports have found autogenous AVFs often fail to mature due to previous venous catheters or co-morbid issues such as diabetes, peripheral vascular disease and advanced age. The present study aimed to study long-term patency rate of autogenous AVFs in elderly patients and to compare functional outcomes with interims of 1-, 3-, 5-year patency rate and post-operative complications between patients aged over and under 60 years. The present study used 60 years for the cut-off age because most populations are inactive occupational and retired from work.

MATERIALS AND METHODS

A retrospective case-control study was carried out to collect data of patients who underwent autogenous AVF at Bangkok Metropolitan Administration General Hospital, Bangkok, Thailand from January 2003 to June 2007. The protocol was approved by the Institutional Ethical Committee. The inclusion criteria were (1) ESRD patients who underwent autogenous AVF formation, (2) the surgery was performed by the author, and (3) the procedure was performed according to the NKF KDOQI practice guideline. The patients were assigned to Group 1 (age over 60 years) or Group 2 (age under 60 years). The exclusion criteria were ESRD patients who underwent arterial-venous graft.

Demographic data and the number of autogenous AVF for each individual were compared between two groups. Co-morbid conditions including diabetes mellitus, hypertension, ischemic heart disease, malignancy, peripheral vascular disease, lung disease and hyperlipidemia were recorded. The following data were collected: type and location of autogenous AVF, creation date and follow-up for the study period. Survival function in 1, 3, 5 years (1-, 3-, 5-year patency

rate) and post-operative complications were analyzed.

Definitions

Autogenous AVF: the connection of a vein and an artery to allow access to the vascular system for hemodialysis without prosthetic usage. The fistula develops over a period of months after surgery.

ESRD: the complete or almost complete failure of the kidneys to function. The kidneys can no longer remove wastes, concentrate urine, and regulate many other important functions.

Patency rate⁴: ability of AVF to deliver adequate flow rate greater than 350 ml/m to maintain treatment time less than 4 hours without access recirculation in study period

Stealsyndrome^{5,6}: ischemic complication resulted from preferential diversion of arterial flow into the low-pressure venous outflow of the AV access (categorized to mild, moderate and severe). This phenomenon may manifest as cool digits or profound ischemic changes, such as tissue loss.

Statistical Analysis

Data were analyzed using the Statistic Software SPSS version 16.0. Data were expressed as mean \pm SD. Chi-square test, independent samples t-test and Fisher's exact test were used to compare parameters between two groups. Survival analysis was used to calculate 1-, 3-, 5-year patency rate. Patency rates for both groups were analyzed with Kaplan-Meier survival analysis and Log rank test. Cox regression analysis determined

factors associated with patency loss. For all comparisons, significance was set at less than 0.05.

RESULTS

Between January 2003 and June 2007, 343 patients had operations on creation of autogenous AVF at the Bangkok Metropolitan Administration General Hospital. Only 217 patients were satisfied with the inclusion criteria and included in the present study with a mean age of 57.24 years (range 15-93 years). One hundred and twenty six patients were excluded because surgery performed by other surgeons and the operation was not done according to NKF KDOQI practice guideline. There were 112 patients aged over 60 years in Group 1 and 105 patients under 60 years in Group 2.

Demographic data and the number of patients for each individual were compared between two groups (Table 1). There was no significant difference in the proportion of gender between these two groups. There was no significant difference between the two groups with respect to each of the co-morbid diseases. There were no significant differences in type of autogenous arteriovenous fistula (Table 2) and biochemical data (creatinine, hematocrit, albumin, blood sugar) in both groups (Table 3).

Steal syndrome was found in two patients (one in each group). This was treated by the direct suture with 6-0 polypropylene to narrow the anastomosis diameter with good outcome. Surgical site infection was found

Table 1 Demographic data

	Group 1 (n = 112)	Group 2 (n = 105)	p-value
Age(years) (mean \pm SD)	70.25 \pm 7.40	43.35 \pm 10.88	<0.001**
Sex (male : female)	46 (41.1%) : 66 (58.9%)	51 (48.6%) : 54 (51.4%)	0.267**
Co-morbid diseases			
- Diabetic mellitus	55 (49.1%)	46 (43.8%)	0.434**
- Hypertension	99 (88.4%)	88 (78.6%)	0.328**
- Ischemic heart disease	22 (19.6%)	18 (17.1%)	0.635**
- Malignancy	1 (0.9%)	1 (1%)	1.000***
- Peripheral vascular disease	8 (7.1%)	9 (8.6%)	0.696**
- Lung disease	9 (8%)	11 (10.5%)	0.535**
- Hyperlipidemia	56 (50%)	46 (43.8%)	0.361**
Duration of disease before operation (months) (mean \pm SD)	16.1 \pm 8.6	13.6 \pm 8.2	0.028*

*p-value by unpaired t-test, **p-value by Chi-square test, ***p-value by Fisher's exact test

Table 2 Types of operation

	Group 1 (n = 112)	Group 2 (n = 105)	p-value
Radial artery-cephalic vein autogenous arteriovenous fistula at the wrist (RC)	50 (44.6%)	51 (48.6%)	0.687**
Brachial artery-cephalic vein autogenous arteriovenous fistula upper arm (BC)	50 (44.6%)	46 (43.8%)	
Transposed brachial artery-basilic vein autogenous arteriovenous fistula (TBB)	12 (10.8%)	8 (7.6%)	

*p-value by unpaired t-test, **p-value by Chi- square test

Table 3 Biochemical data before operation

	Group 1	Group 2	p-value
Creatinine (mg/dl)	6.9 ± 2.1	7.1 ± 2.1	0.685*
Hematocrit (%)	32.8 ± 4.2	32.1 ± 4.3	0.173*
Albumin (g/dl)	3.4 ± 3.1	3.1 ± 0.3	0.481*
Blood sugar (mg/dl)	143.0 ± 69.7	134.9 ± 52.9	0.341*

*p-value by unpaired t-test

Table 4 Post-operative complications

	Group 1	Group 2	p-value
1. Active bleeding or hematoma at surgical site	2 (1.8%)	1 (1%)	1.000***
2. Surgical site infection	2 (1.8%)	2 (1.9%)	1.000***
3. Steal syndrome	1 (0.9%)	1 (1%)	1.000***
4. Swelling at operated arm	5 (4.5%)	7 (6.7%)	0.478**

p-value by Chi- square test *p-value by Fisher's exact test

Table 5 Patency rate in AVF

	Patency rate(%)			p-value
	1 year	3 year	5 year	
Group 1	76.8	54.5	48.2	0.387
Group 2	81	65.2	53.3	

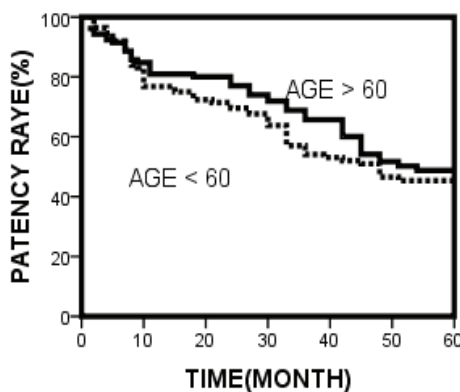


Figure 1 Patency rate by age group
Patency at 1, 3, 5 years did not show differences by age group

in two patients of each group and was treated by dressing and oral antibiotic. Hematoma at surgical site was found in three patients (two patients in Group 1 and one patient in Group 2). All were improved by conservative treatment. Swelling at operated arm was found in twelve patients (five patients in Group 1 and seven patients in Group 2). Every patient was improved by conservative treatment. Comparison of complications did not show significant differences (Table 4).

In univariate analyses, diabetes, operative time, laboratory creatinine and perioperative complication (active bleeding or hematoma at surgical site, surgical site infection, swelling at operated arm) were related to functional patency loss. On multivariate survival analysis, diabetes (HR = 2.837; 95% CI = 1.912-4.208, p < 0.001), active bleeding or hematoma at surgical site (HR = 4.281; 95% CI = 1.328-13.795, p = 0.015) and surgical site infection (HR = 8.642; 95% CI = 3.079-24.255, p < 0.001) were significantly related to functional patency loss.

DISCUSSION

There are controversies regarding the feasibility of autogenous AVF creation in hemodialysis patients. The options for vascular access in elderly ESRD patients should not be different from younger patients. The most preferable method of vascular access in maintaining hemodialysis is a autogenous AVF.⁷⁻¹¹ Autogenous AVF is technically feasible in most patients over 60 years and should always be considered as the first choice.

In the present study the duration of disease before operation in elderly was significantly longer than that of younger patients, possibly due to over-looked diagnosis. Ridao-Cano et al⁹ showed there were no significant differences in patency rates between patients younger or older than 65 years (log-rank comparison

Table 6 Patency rate in AVF for ESRD patients age over 60 years (Group1)

	Patency rate (%) Age >60 years			
	1 year	3 year	5 year	p-value
1. Male	73.9	50	45.7	0.665
Female	78.8	57.6	50	
2. Non-DM	96.5	71.9	61.4	0.001
DM 56.4	36.4	34.5		
3. Type of operation	0.768			
3.1 radial artery-cephalic vein AVF at the wrist (RC)	74	52	44	
3.2 brachial artery-cephalic vein AVF at upper arm (BC)	76	58	52	
3.3 transposed brachial artery-basilic vein AVF (TBB)	91.7	50	50	

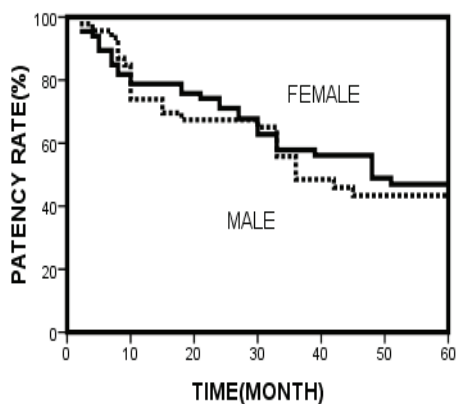


Figure 2 Patency rate in age >60 years group by gender. Gender did not show differences patency in age >60 years group.

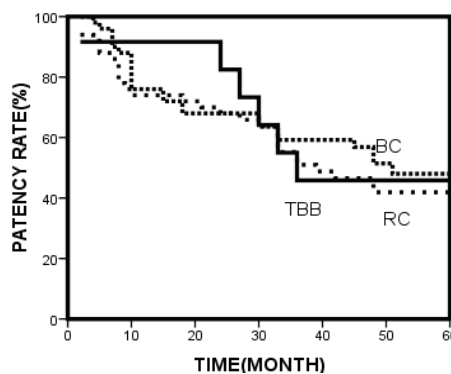


Figure 4 Patency rate in age >60 years group by fistula type. The type of fistula did not show significances in patency.

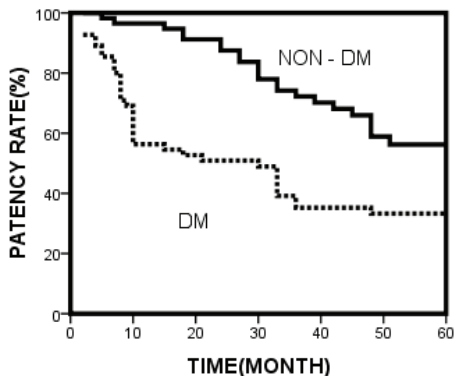


Figure 3 Patency rate in age >60 years group by diabetes. The patency between diabetic and non-diabetic was significant differences.

between curves, $p < 0.001$). Grapsa¹⁰ reported no significant differences in 5-year patency rate in both groups (35% in patients over 60 years of age and 45% in patients under 60 years) same as the present study. Latos¹ showed AVF is probably the safest and least likely to become infected or result in arterial steal

syndrome and reported vascular access complications in the elderly are similar to the younger patients. The present study also showed that complications of AVF in the elderly are similar to those seen in younger patients. Active bleeding or hematoma at surgical site and surgical site infection related to functional patency loss. Age should not be a limiting factor when determining for autogenous AVF creation due to equivalent survival and complication rate.¹²

López-Menchero et al¹³ showed diabetes was an unfavorable factor for patency but not significantly different and Huijbregts et al¹⁴ identified diabetes as a risk factor associated with patency loss but not with significance. In the present study diabetic patients in elderly diabetic patients had lower patency with significant differences than younger patients. These results indicate that elderly patients with diabetes may encounter more failure during continuous use of the fistula because there might have been more vascular damage than non-diabetic elderly patients. Berardinelli

et al¹⁵ had demonstrated that gender and various types of AVF were not significant different in patency rate of elderly patients. Weale et al¹⁶ concluded age did not influence the site of surgical access. The present study also showed gender and type of fistula did not result in significant differences in patency rate. Surgeons should be concerned about diabetic patients due to early failure in function of AVF. Complication should be detected early and treated to prevent patency loss. The limitation of this study is that all AVFs are performed by only one surgeon. In addition, it is a retrospective study which can be prone to bias and errors.

CONCLUSION

Autogenous AVF is the first angioaccess for hemodialysis also in older patients. Survival of the autogenous AVF is independent of age. There is no difference in complications across age groups. Duration of disease before operation in elderly was longer than younger patients with significance but not associated with patency loss. Patency rates in non-diabetic elderly patients with significance. Gender and type of AVF in elder patients were not significantly different in patency. Diabetes, active bleeding or hematoma at surgical site and surgical site infection were related to functional patency loss.

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