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Original Research Article

Creation and outcome of arteriovenous fistula for hemodialysis: experience in a tertiary care hospital in Saurashtra, Gujarat, India

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ABSTRACT

Background: Patients with chronic kidney disease require arteriovenous fistulas for hemodialysis. The aim of our study was to share our experience of creating arteriovenous fistulas for hemodialysis and to analyze the factors affecting the outcome of arteriovenous fistulas.
Methods: This is a prospective study carried out in Guru Gobind Singh Government Hospital, Jamnagar from August 2013 to July 2015. All patients with chronic kidney disease in whom arteriovenous fistula was created surgically for hemodialysis were included in this study.
Results: Maximum patients (34%) were in the age group of 51-60 years. 76% of the patients were males and 24% were females. Co morbid conditions like diabetes mellitus, hypertension and ischemic heart disease were present in 20%, 26%, and 16% of patients respectively. Success rate of arteriovenous fistulas in patients with diabetes mellitus, hypertension and ischemic heart disease was 30%, 69.2% and 25% respectively. Success rate of arteriovenous fistulas in patients without diabetes mellitus, hypertension and ischemic heart disease was 92.5%, 83.8% and 90.5% respectively. Early failure was present in 20% of the patients. Most common cause of early failure was thrombosis, which occurred in 8% of total patients. Other causes of early failure were wound infection, stenosis and aneurysm, which occurred in 6%, 4% and 2% patients respectively.
Conclusions: Presence of diabetes mellitus and ischemic heart disease was associated with a higher risk of arteriovenous fistula failure. The success rate reported in our study was fairly acceptable.

Keywords: Arteriovenous fistula, Chronic kidney disease, Hemodialysis

INTRODUCTION

Patients with End Stage Renal Disease (ESRD) require renal replacement therapy for their survival. This can be in the form of renal transplantation or dialysis (hemodialysis or peritoneal dialysis). Hemodialysis is done in many of ESRD patients because of lack of availability of kidney donors for renal transplantation and limited use of peritoneal dialysis.[1]

The most important factor for proper hemodialysis is vascular access. It can be done by creation of arteriovenous fistula (AV fistula) or by arteriovenous graft or by inserting a central venous catheter in the internal jugular or femoral vein. Successful outcome of creating an AV fistula depends on proper patient selection, co morbidities of the patient, condition of the upper limb where fistula is to be created and proper pre procedural, intra and post-operative care.[2]

The aim of our study was to share our experience of creating AV fistulas for hemodialysis and to analyze the factors affecting the outcome of AV fistulas.

METHODS

This was a prospective study carried out in Guru Gobind Singh Government Hospital, Jamnagar during the period of August 2013 to July 2015. All patients with chronic kidney disease (CKD) in whom AV fistula was created surgically for hemodialysis were included in this study. Informed, written consent was taken from all patients. Detailed history of all patients was taken including their age and gender, the duration and progression of their CKD with associated symptoms, history of co morbid conditions like diabetes mellitus (DM), hypertension and ischemic heart disease (IHD), dietary habits and addictions. Complete physical examination was done. Investigations like complete blood count, random blood sugar, renal function test, chest x ray, HIV, HbsAg, HCV, ultra-sonogram of abdomen and pelvis was done. Pre-operative, operative and post-operative steps were noted. Intra operative and post-operative complications were noted.

Data was analyzed in excel and statistical analysis was done using Epiinfo.

Preoperative preparation

Complete examination of the arterial system of both upper limbs was done including the peripheral pulses, blood pressure and Allen's test. Complete examination of the venous system of both upper limbs was also done. Non dominant upper limb was used for creation of AV fistula. Patients were instructed not to take any intravenous or intramuscular injections on that upper limb. Patient was given prophylactic antibiotics. Shaving of forearm was done before operation. Injection Tetanus Toxoid 0.5 ml was given intramuscularly. Test dose of lignocaine was given 30 minutes before the procedure.

Position

Patient was kept in supine position. The upper extremity from the wrist to the elbow was included in the operative field and was positioned on the hand table attached to the standard operating room table.

Painting and draping

Painting was done with betadine and isolation of the operative field was done with autoclaved towel.

Local anesthesia

The 10 ml of 5% lignocaine was infiltrated at the site of incision.

Incision

A single 3 cm longitudinal incision was made over the anterior aspect of the wrist.

Isolation of the cephalic vein

A small skin flap was elevated and distal cephalic vein was disected from surrounding tissue. The vein was dissected beyond the distal extent of the incision to assure a sufficient length to transpose onto the artery.

Isolation of the radial artery

A second skin flap was elevated for exposure of the radial artery and the investing deep fascia over the artery was cut with scissors or cautery. Small branches of the desired segment of the artery were ligated with prolene 6-0. 4-5 cm of artery was exposed for tension free anastomosis.

Bulldog application

After adequate exposure of the radial artery and cephalic vein, 2 bulldog clamps were applied over the proximal and the distal end of the exposed artery and vein to occlude the flow of the vessels and prevent bleeding during anastomosis.

Arteriotomy

A 1 cm arteriotomy was created using number 11 stab knife and was flushed with heparinized normal saline.

Venotomy

A similar parallel incision of 1 cm was placed over the vein with number 11 stab knife and the lumen was washed with heparinized normal saline.

Anastomosis

Side to side anastomosis was started by suturing the posterior layer of artery and vein with 6-0 prolene (double needle round body), in continuous non locking running stitch. After completion of the posterior layer stitch, continuous corner stitch and anastomosis of the anterior layer of artery and vein was done in similar fashion. Before completion of the anterior layer, proximal vein and artery was flushed with heparinized normal saline solution. Then the remaining anterior layer was closed. On table, anastomosis was palpated; presence of thrill indicated successful AV fistula. The venous side towards the palm was tied with prolene 6-0 to avoid venous hypertension in the palm.

Skin closure

Skin was closed by interrupted vertical mattress sutures using prolene 4-0.

Sterile dressing

Sterile dressing was put over the stitch line and patient was shifted to recovery room.

Post-operative

Post operatively antibiotics, analgesics, antiemetic and anti-platelet drugs were given. Patient was advised to do palmer exercise with soft ball. Instruction was given to avoid blood collection from the operated upper limb. Patient was told to avoid blood pressure cuffs, constrictive clothing and jewellery on the operated arm.

Patients were followed up on 2nd post-operative day to check the functioning of the fistula. Stitches were removed on 14th post-operative day. All patients were followed up at 3 months. Presence of thrill at fistula site at 3 months indicated patent fistula. Early failure of AV fistula was defined as the fistula that is never usable for hemodialysis or that which fails within 3 months of use.

RESULTS

Table 1 shows age wise distribution of the patients included in the study. Maximum patients (34%) were in the age group of 51-60 years. Table 2 shows gender wise distribution of the patients included in the study. There was a male preponderance as 76% of the patients were males and 24% were females.

Table 1: Age wise distribution (n=50).

Age (years)	Number of patients	Percentage of patients (%)
Less than 20	3	6
21 – 30	5	10
31 – 40	5	10
41 – 50	12	24
51 – 60	17	34
61 – 70	8	16
Total	50	100

Table 2: Gender wise distribution (n=50).

Gender	Number of patients	Percentage of patients (%)
Male	38	76
Female	12	24
Total	50	100

Table 3: Presence of co morbid conditions (n=50).

Co morbid conditions	Present (number)	Present (%)
Diabetes mellitus	10	20
Hypertension	13	26
Ischemic heart disease	8	16

Table 3 shows presence of co morbid conditions in patients included in the study. Hypertension was the most common co morbidity present in 26% of the patients.

Table 4: Outcome of AV fistulas in patients with and without diabetes mellitus.

Diabetes mellitus	Success	Failure	Total
Present	3 (30%)	7 (70%)	10
Absent	37 (92.5%)	3 (7.5%)	40
Total	40	10	50

As it is seen in Table 4, success rate of AV fistulas in patients with diabetes mellitus was only 30% and failure rate was 70%. In patients without diabetes mellitus, success rate and failure rate was 92.5% and 7.5% respectively. This difference is statistically significant (p=0.0001) (OR=0.03, 95% CI=0.006-0.20). Presence of diabetes mellitus was associated with a higher chance of failure of AV fistulas.

Table 5 shows that the success rate of AV fistulas in patients with and without hypertension is 69.2% and 83.8% respectively and failure rate in patients with and without hypertension is 30.8% and 16.2%. This difference is not statistically significant (p=0.4202) (OR=0.4, 95% CI=0.1-1.9). Presence of hypertension was not associated with a higher risk of failure of AV fistulas.

Table 5: Outcome of AV fistulas in patients with and without hypertension.

Hypertesion	Success	Failure	Total
Present	9 (69.2%)	4 (30.8%)	13
Absent	31 (83.8%)	6 (16.2%)	37
Total	40	10	50

Table 6: Outcome of AV fistulas in patients with and without ischemic heart disease.

Ischemic heart disease	Success	Failure	Total
Present	2 (25%)	6 (75%)	8
Absent	38 (90.5%)	4 (9.5%)	42
Total	40	10	50

As it is seen in Table 6, success rate of AV fistulas in patients with IHD was only 25 % and failure rate was 75%. In patients without IHD, success rate and failure rate was 90.5% and 9.5% respectively. This difference is statistically significant (p=0.0003) (OR=0.035, 95% CI=0.005-0.2). Presence of IHD was associated with a higher chance of failure of AV fistulas.

Table 7 shows incidence and causes of early failure occurring in the patients included in the study. Out of 50 cases, early failure was present in 20% of the cases. Most

common cause of early failure of AV fistula was thrombosis, which occurred in 8% of total patients.

Table 7: Incidence and causes of early failure (n=50).

Early failure	Present (number)	Present (%)
Thrombosis	4	8
Infection	3	6
Stenosis	2	4
Aneurysm	1	2
Total	10	20

DISCUSSION

KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease3 defines chronic kidney disease as "abnormalities of kidney structure or function, present for more than 3 months, with implications for health." It gives criteria for CKD as: Albuminuria (Albumin Excretion Rate ≥30 mg/24 hours; Albumin Creatinine Ratio ≥30 mg/g, abnormalities in urine sediment, electrolyte and other abnormalities due to tubular disorders, abnormalities in kidneys detected by histology, structural abnormalities in kidneys detected by imaging, history of kidney transplantation and decreased Glomerular Filtration Rate (GFR) < 60 ml/min/1.73 m^2. Either of the criteria should be present for more than 3 months to define a patient as having CKD. When the GFR is less than 15 ml/min/1.73 m2 the patient is said to be having renal failure. Renal replacement therapy is required for the survival of ESRD patients. Renal replacement therapy can be in the form of renal transplantation or dialysis (hemodialysis or peritoneal dialysis). The most preferred mode of vascular access for hemodialysis is AV fistula. Order of preference of the type of AV fistula is: 1-radiocephalic fistula, 2-brachiocephalic fistula, 3-transposed brachial basilic vein fistula.[4]

In our study, we created radiocephalic fistula in all our patients. A majority of patients in this study were males (76%). This finding is consistent with that reported by Sahasrabudhe et al.[5] and Sahin et al1. They reported that there were 65.7% and 62.07% males in their study respectively.

A majority (34%) of patients in our study were in the age group of 51 to 60 years. This is different from the study reported by Salako et al.[2] in which a majority (35%) of patients were in the age group of 41 to 50 years while only 17.5% patients were in the age group of 51 to 60 years. In our study we found that co morbidities like diabetes mellitus, hypertension and IHD were present in 20%, 26 %, and 16% of cases. Hypertension was the most common co morbid condition present. In the study done by Sahasrabudhe et al,[5] diabetes mellitus was present in almost half (48.7%) of the patients. Huijbregts et al reported 23% patients as having coronary artery disease and 33% patients as having diabetes mellitus.[6] The proportion of patients having diabetes and IHD in our study is less compared to these studies.

In our study, success rate of AV fistulas in patients with diabetes mellitus was only 30% and failure rate was 70%. In patients without diabetes mellitus, success rate and failure rate was 92.5% and 7.5% respectively. Thus presence of diabetes was associated with a higher chance of failure of AV fistula. Similarly, success rate of AV fistulas in patients with IHD was only 25 % and failure rate was 75%. In patients without IHD, success rate and failure rate was 90.5% and 9.5% respectively. Presence of IHD was also associated with a higher chance of failure of AV fistulas. We also found that the success rate of AV fistulas in patients with and without hypertension is 69.2% and 83.8% respectively and failure rate in patients with and without hypertension is 30.8% and 16.2%. Thus presence of hypertension did not adversely affect the outcome of AV fistula in our study.

Authors findings differ from the study reported by Wang et al, in which no co morbid diseases influenced the primary AV fistula success.[7] Ravani et al, reported that presence of cardiovascular disease was associated with an increase in probability of AV fistula failure.[8]

Out of 50 cases included in this study, early failure was present in 20% of the cases. Most common cause of early failure was thrombosis which occurred in 8% of total patients. Other causes were wound infection, stenosis and aneurysm which occurred in 6%, 4% and 2% patients respectively. Steal phenomenon, distal limb edema and major bleeding requiring intervention did not occur in our study. In the study by Sahasrabudhe et al, failure rate was 27% of which most had no definable cause.

Among reported complications, 5.9% patients developed distal limb edema and 11.8% patients developed steal phenomenon and complications like aneurysm, operative site infection and major bleeding requiring intervention did not occur.[5] In our study, failure rate was lower and all the causes of failure were identified. In the study by Sahin et al, complications occurred in 13.12% cases. Thrombosis occurred in 9.37% cases, bleeding in 1.81%, hematoma in 0.62% cases, steal phenomenon in 1.25% cases and no infection or aneurysm occurred. The success rate was 95% at 1 month and 90% at 6 months which is higher than our study which had success rate of 80%. The higher rate of success in that study was due to thrombectomy done in AV fistulas with thrombosis, which was not done in our study.[1]

Main limitations of our study are its small sample size and measurement of only short term outcome. Also, we did not measure the vessel size and its effect on the outcome of AV fistula. Correlation between vessel size and co morbid conditions was not evaluated. We did not perform thrombectomy in AV fistula with thrombosis, which, if done, may increase the successful outcome.

CONCLUSION

Authors concluded that presence of diabetes mellitus and ischemic heart disease was associated with a higher risk of AV fistula failure. The success rate reported in our study was fairly acceptable.

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Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Şahin M, Bıçakhan B, Akkoç İ. A Retrospective Evaluation of Outcomes of Arteriovenous Fistulas for Hemodialysis. Med Bull Haseki. 2018;56:28-31.
2. Salako AA, Badmus TA, Igbokwe MC, David RA, Laoye A, Akinbola IA, et al. Experience with arteriovenous fistula creation for maintenance hemodialysis in a tertiary Hospital in South-Western Nigeria. Saudi J Kidney Dis Transpl. 2018;29(4):924-9.
3. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney inter., Suppl. 2013;3:1-150.
4. National Kidney Foundation. KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for 2006 Updates: Hemodialysis Adequacy, Peritoneal Dialysis Adequacy and Vascular Access. Am J Kidney Dis. 2006:48:S1-S322.
5. Sahasrabudhe P, Dighe T, Panse N, Patil S. Retrospective analysis of 271 arteriovenous fistulas as vascular access for hemodialysis. Indian J Nephrol. 2013;23:191-5.
6. Huijbregts HJT, Bots ML, Wittens CHA, Schrama YC, Moll FL, Blankestijn PJ. Hemodialysis Arteriovenous Fistula Patency Revisited: Results of a Prospective, Multicenter Initiative. Clin J Am Soc Nephrol. 2008;3:714-9.
7. Wang W, Murphy B, Yilmaz S, Tonelli M, Macrae J, Manns BJ. Comorbidities do not influence primary fistula success in incident hemodialysis patients: a prospective study. Clin J Am Soc Nephrol. 2008;3(1):78-84.
8. Ravani P, Brunori G, Mandolfo S, Cancarini G, Imbasciati E, Marcelli D, et al. Cardiovascular comorbidity and late referral impact arteriovenous fistula survival: A prospective multicenter study. J Am Soc Nephrol. 2004;15:204-9.

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