

Original research article

## **A Prospective Study to Identify the Risk Factors for Failure of Brachio-cephalic Arterio-venous Fistula (BC AVF), at a Tertiary Care Hospital in Haryana.**

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### **Abstract**

**Introduction:** Chronic kidney disease (CKD) is increasingly being recognized as a global public health problem. The focus in CKD has changed from treating a terminally ill patient, to dealing with a person who has a manageable chronic disease that requires long term care. Hemodialysis (HD) is the most commonly used method of dialysis. Arteriovenous fistulas (AVF) are considered the gold standard for hemodialysis access based on their superior patency, low complication rates, improved adequacy, lower cost to the healthcare system and decreased risk of patient mortality. **Aim:** to identify the risk factors for failure of Brachio-cephalic arterio-venous fistula (BC AVF). **Methodology:** This was a single centre, observational longitudinal study done on 98 patients with Brachio-cephalic arterio-venous fistula (BC-AVF). **Results:** We observed that majority patients were between 51-70 years of age. Two fistulas that failed during the 15 days follow up were in age group >70 years, 3 fistulas that failed at 30days follow up were in age group between 51-70 years.

**Keywords:** CKD, AV Fistula, Hemodialysis

### **Introduction**

Chronic kidney disease (CKD) is increasingly being recognized as a global public health problem. The pattern of disease burden in the 21<sup>st</sup> century has significantly shifted towards chronic kidney disease.<sup>1</sup>

The focus in CKD has changed from treating a terminally ill patient, to dealing with a person who has a manageable chronic disease that requires long term care. The changes in focus are the result of the technical advances in dialysis and improved surgical techniques. Hemodialysis (HD) is the most commonly used method of dialysis.<sup>2</sup> Hemodialysis can be done as outpatient or inpatient therapy. Routine hemodialysis is conducted in a dialysis outpatient facility.<sup>3</sup> The most long lasting access is created surgically known as fistula, by joining an artery to vein either side to side or end to side. As for CRF patients, hemodialysis should be repeated three

times a week for at least three to four hours per dialysis; thus it is the best method to use arteriovenous fistula (AVF) as a vascular access. Compared to other vascular access such as venous catheter and a synthetic graft, arteriovenous fistula is the most commonly used method as it has fewer complications.<sup>4</sup>

Arteriovenous fistulas (AVF) are considered the gold standard for hemodialysis access based on their superior patency, low complication rates, improved adequacy, lower cost to the healthcare system and decreased risk of patient mortality. Brachio-cephalic fistula has high primary and secondary patency rates as compared to radiocephalic fistula.<sup>5</sup> Ates et al<sup>6</sup> in their study have stated that the risk factors for AVF failure include inadequate anatomy, obesity, older age, female gender, cardiac disease, and diabetes mellitus; most of which are part of a CKD patient.

There is a significant failure rate for autogenous arteriovenous fistulas (AVF), estimated at 0.2 events per patient / year. For AV graft, this increases to 0.8-1.0 events per patient /year.<sup>7,8</sup> Thus considering the importance of an arteriovenous fistula in the management of such a high burden illness of CKD; and the associated failures with this procedure causing significant morbidity to the patients, it is of paramount importance to know more and more as to how best create and maintain an AVF. The aim of the present study is to identify the risk factors for failure of Brachio-cephalic arterio-venous fistula (BC AVF).

### Methodology

This was a single centre, observational longitudinal study done on 98 patients with Brachio-cephalic arterio-venous fistula (BC-AVF). Procedure was conducted in the department of peripheral vascular and endovascular surgery at Medanta - The Medicity Hospital, Gurgaon, Haryana from October 2015 to April 2017 to determine the risk factors for failure of brachiocephalic fistula. Based on the available literature on failure of brachio-cephalic arterio-venous fistula<sup>9</sup>, the sample size worked out as 75. All patients requiring hemodialysis and undergoing Brachio-cephalic AV Fistula creation were included in our study. Exclusion criteria included patient having central venous obstruction, Cephalic vein diameter <2.5mm, Brachial artery diameter < 2mm, Thrombophlebitic vein (thickened wall/echo texture), Depth of cephalic vein >6mm, Local skin infection at fistula site.

Follow up:

Follow up of patients were taken on 15±2 (visit-1) post operative day, on 30±7 days (visit-2) and at 6 months±7 days (visit-3) or earlier depending on status of fistula. During follow up, patency and complication of brachio-cephalic fistula were recorded. In particular, vein diameter was measured by Duplex Ultrasound with a tourniquet, inner wall to inner wall, using B-mode technique. The non dominant upper limb was usually preferred.

### Results

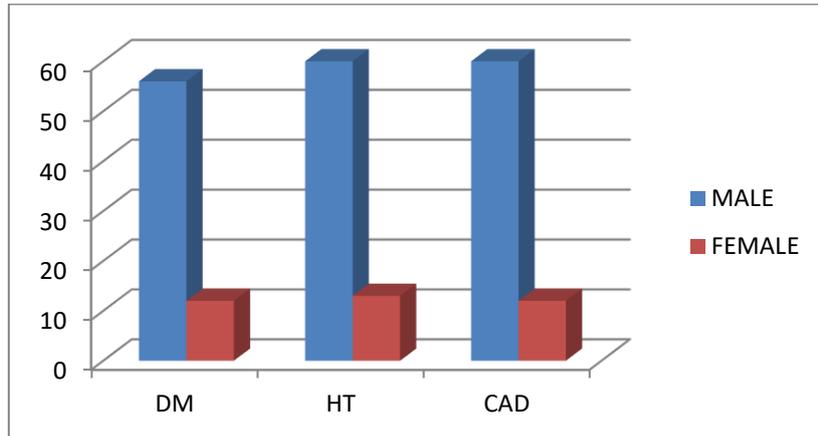
We observed that majority patients were between 51-70 years of age. 66 cases in our study were between 51 – 70 years which accounted for 67 % of cases. Of the 98 patients 81% of the patients were males (79) and 19% were females.

In this study, between 30-50 years of age 4 fistulas were right sided and 15 were left sided. 19 fistulas were right sided and 47 were left sided in the age group of 51 – 70 years. In this study, 68 patients were diabetic (70%) in which 56 were males and 12 were females. 73 patients were hypertensive (75%) in which 60 were males and 13 were females. 72 patients had coronary artery disease (74 %) in which 60 were males and 12 were females

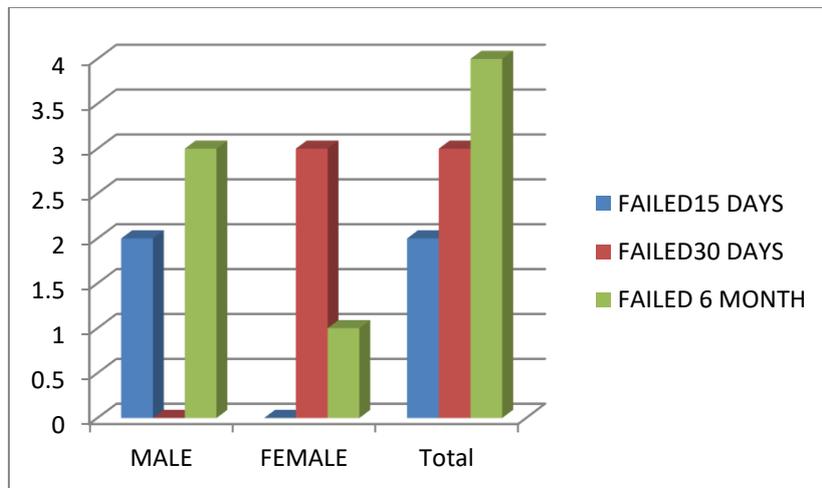
Two fistulas that failed during 15 days follow up groups were in males, 3 fistulas that failed during 16-30 days follow up were in females. Two fistulas that failed during the 15 days follow up were in age group >70 years, 3 fistulas that failed at 30days follow up were in age group between 51-70 years.

During 6 months follow up, 2 fistulas failed in the age group between 51-70 years and 2 other fistulas failed in the age group of >70 year. Four fistulas that required assisted maturation were in the age group of 51-70 years and 6 other fistulas that required assisted maturation were in the age group of >70 years. Statistical significance was noted with P values of 0.001 and <0.001 during 15 days and 6 months follow up respectively.

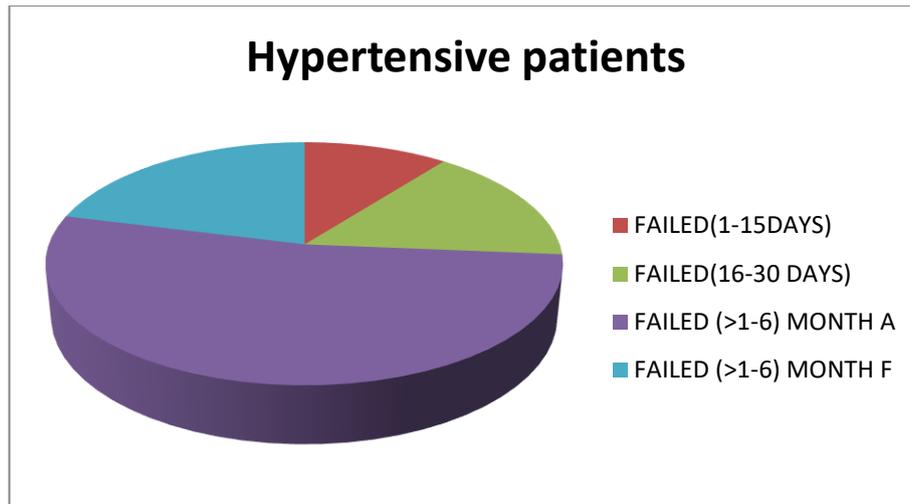
In our study a total of 9 patients who had failure of fistulas were diabetic. In 6 months follow up group 10 fistulas required assisted maturation in which 9 patients were diabetic. [p>0.05] All fistulas that failed in our study were in hypertensive patients. Total 10 fistulas required assisted maturation in which nine were in hypertensive patients. Total 9 fistulas that failed in our study were in dialysis dependent patients. Eight out of nine patients with failed fistulas in our study had ipsilateral dialysis catheter. [p<0.05]. Total 9 patients with failed fistulas in our study had coronary artery disease.



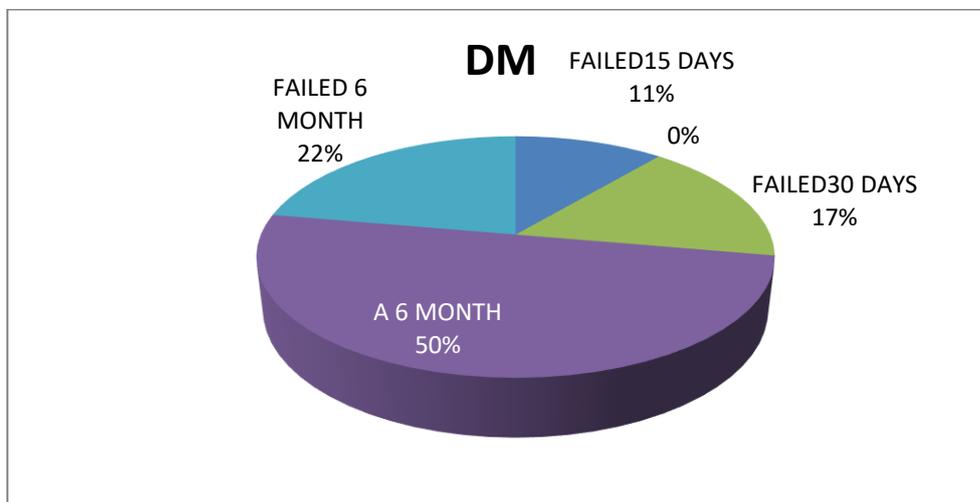
**Figure 1: Distribution of Diabetes, Hypertension and Coronary artery disease among patients**



**Figure 2: Sex distribution among failed fistula**



**Figure 3: Failed fistula among hypertensive patients**



**Figure 4: Failed fistula among Diabetic patients**

### Discussion

In our study the mean age was 59.34 years  $\pm$  10.61SD(standard deviation). There was male preponderance in our study with 81% of the patients being males (79) and 19% being females (19). Out of the 98 fistulas 25 were created on the right side and 73 on the left side. A study was done by C.J. Zeebregts et al<sup>9</sup> in which 100 autologous brachio-cephalic fistulas were created in 96 patients. There were 60 % ( 57) male and 40 % (39) female patients with a mean (SD) age of 59.2 (15.6) (range 21–82) years.

A study was done by Andy R. Weale et al<sup>10</sup> in which out of 658 patients 211(32%) patients were diabetic, 391(60%) patients were hypertensive. The higher incidence of diabetic patients in our study is likely due to the high prevalence of DM in India.

In our study, failure of fistula had a statistically significant P value in females during 30 days follow up and in rest all other follow up groups, the P value was insignificant. Miller et al<sup>11</sup> reported worse primary failure among women compared to men (68% versus 50%), but Caplin et al<sup>12</sup> found no difference (28% versus 23%) when preoperative ultrasound was used. In our study, failure rate of brachio-cephalic fistula was higher in elderly age group (>50 yrs). Study done by Andy R. Weale et al<sup>10</sup> showed that age did not affect usability, primary or

secondary patency of either RCAVFs(Radiocephalic fistulas) or BCAVFs( brachio-cephalicfistulas).

A comparative study done by C.J. Zeebregtset al<sup>9</sup> also showed that diabetes mellitus was identified as a significant predictor of failure by univariate analysis. Primary assisted and secondary patency rates can, however, be brought to a much higher level, especially in patients without diabetes and a large diameter venous outflow tract.

All patients with failed fistulas and also who required assisted maturation in our study were dialysis dependent. P value was statistically significant in 6 month follow up group (P = 0.016). Previous study done by Claude J.Renaud et al<sup>13</sup> showed that dialysis initiation with a tunneled catheter were significant risk factors for non maturation of primary autogenous fistulas. Study done by C.J. Zeebregtset al<sup>9</sup>also showed that fistula failure rate was more in dialysis dependent patient. A study done by Andy R. Weale et al<sup>10</sup>showed that patients withline hemodialysis before surgical access had increased chance of fistula failure. P value was statistically significant (<0.001).

A study done by Claude J. Renaud et al<sup>13</sup>showed that out of 280 patients with fistulas, 123 patients had coronary artery disease and P value was also statistically insignificant. Several factors could affect the AVF patency but after analyzing the various factors involved in the study, we would like to conclude that failure rate of brachio-cephalic fistula was high.

### Conclusion:

We can conclusively enumerate following risk factors for failure of Brachio-cephalic fistula:

- 1) In patients who had co-morbidities (diabetes, hypertension, coronary artery disease)
- 2) In patients age >50 years.
- 3) In patients already on dialysis.
- 4) In patients with ipsilateral dialysis catheter
- 5) In female patients

### References:

1. Gonzalez Compta X.Origin of the radial artery from the axillary artery and associated hand vascular anomalies.J Hand Surg Am.1991 Mar 1;16 (2):293-96.
2. Lewis SM, Collier IC, Heitkemper MM. Urinary disorder. In:Elizabeth Nieginism, Helen kogut, editors.Medical Surgical Nursing-Assessment and Management of Clinical Problem. United states of America .2002; 1372, 1379, 1392.
3. Legrand. M,Darmon.M, Joannidis, M. Payen D. Management of renal replacement therapy in ICU patients: an international survey,Intensive Care Med. 2013 Jan;39(1):101-8.
4. P. Sahasrabudhe, T. Dighe, N. Panse, S Patil.Retrospective analysis of271 arteriovenous fistulas as vascular access for hemodialysis.Indian J Nephrol. 2013 May-Jun; 23(3): 191–95.
5. Patel PR, Sarah HY, Booth S, Bren V, Downham G,Hess Setal.Bloodstream infection rates in outpatient hemodialysis facilities participating in a collaborative prevention effort: a quality improvement report. Am J Kidney Dis. 2013 Aug 31;62(2):322-30.
6. Ates A,Özyazicioglu A, Yekeler I, Ceviz M, Erkut B, Karapolat S et al. Primary and secondary patency rates and complications of upper extremity arteriovenous fistulae created for hemodialysis.Tohoku J Exp Med. 2006Oct;210(2):91-7.
7. Allon M. Current management of vascular access. Clin J Am Soc Nephrol.2007 Jul; 2(4):786-800.

8. Robbin ML, Gallichio MH, Deierhoi MH, Young CJ, Weber TM, Allon M. US Vascular Mapping before Hemodialysis Access Placement. *Radiology*.2000 Oct;217(1):83-88.
9. Zeebregts CJ, Tielliu IF, Hulsebos RG, de Bruin C, Verhoeven EL, Huisman RM et al.Determinants of failure of brachiocephalic elbow fistulas for haemodialysis.*Eur J Vasc Endovasc Surg*..2005Aug 31;30(2):209-14.
10. Weale AR, Bevis P, Neary WD, Boyes S, Morgan JD, Lear PA, Mitchell DC.Radiocephalic and brachiocephalic arteriovenous fistula outcomes in the elderly.*J Vasc Surg*.2008 Jan 31;47(1):144-50.
11. Miller CD, Robbin ML, Allon M. Gender differences in outcomes of arteriovenous fistulas in hemodialysis patients. *Kidney Int*.2003 Jan 31;63(1):346-52.
12. Caplin N, Sedlacek M, Teodorescu V, Falk A, Uribarri J. Venous access: women are equal.*Am J Kidney Dis*.2003 Feb 28;41(2):429-32.
13. Renaud CJ, Pei JH, Lee EJ, Robless PA, Vathsala A. Comparative outcomes of primary autogenous fistulas in elderly, multiethnic Asian hemodialysis patients.*J Vasc Surg* 2012 Aug 31;56(2):433-39.