



## CLINICAL OUTCOME OF END TO SIDE VERSUS SIDE TO SIDE ARTERIOVENOUS FISTULA FOR DIALYSIS ACCESS AMONG CHRONIC RENAL FAILURE PATIENTS.

### Cardiology

**Dr. K K Sahu**

Assistant Professor, Department of Cardiovascular & Thoracic Surgery, Pt. J. N. M. Medical College, Raipur. (CG)

**Dr. N Chandel\***

Assistant Professor, Department of Cardiovascular & Thoracic Surgery, Pt. J. N. M. Medical College, Raipur. (CG) \*Corresponding Author

### ABSTRACT

**Introduction:** Arteriovenous Fistula (AVFs) is the gold standard for hemodialysis & it is the best modality for hemodialysis access. Anastomotic creation of autogenous arteriovenous fistulas can be performed in different ways; side to side (STS) or end to side (ETS). However, there is a paucity of evidence to recommend them. In this study aimed to describe clinical outcome to AVF surgery for improving early patency rates.

**Objectives:** To compare the results of both surgical techniques for creation of arteriovenous fistula (AVF); End to side (ETS) versus Side to side (STS) artery techniques.

**Materials and Methods:** This is prospective randomised control trial study that is going to be conducted at in department of Cardiovascular and Thoracic Surgery, pt. J. N. M. Medical college Raipur. Patients were divided into two groups according to use of End to side (ETS) & Side to side (STS) technique between May 2019 to June 2019 (2 Monhs), with six month postoperative follow up period. Group I consisted of 25 patients with End to side & Group II consisted of 25 patients with Side to side technique. Both groups were followed for duration of 6 months to assess patency. For evaluating the quantitative variables, t-test was used while qualitative variables were measured using the chi-square and Fisher's exact tests.

**Results:** In this study were included with 25 patients in End to Side (ETS) group and 25 patients in Side to Side (STS) group. Co-morbidities was not found to be significantly associated with the both groups. There were also type of fistula was not found to be significant associated with ETS & STS groups. In the six months duration, 5 patients (20%) in the STS group and 4 patients (16%) in the ETS group experienced a non working AVF. The total failure rate was 18% and during the 6 months of follow up no significant difference was detected in the patency rate.

**Conclusion:** Similar patency rates between ETS and STS fistula configuration, however, type of fistula was not significantly associated with the STS technique.

### KEYWORDS

End to Side (ETS) technique, Side to Side (STS) technique, Co-morbidities, Arteriovenous Fistula

#### Background:

End-stage renal failure is common in world- wide population with the incidence of more than 1,000,000 patients in a year, who are undergone renal replacement therapy<sup>1</sup>. Hemodialysis is simple, cost effective and most common treatment modality in patients with end-stage renal failure<sup>2-4</sup>. The National Kidney Foundation Dialysis Outcomes Quality Initiative, The Fistula First Breakthrough Initiative, and The Society for Vascular Surgery, recommend arteriovenous fistula (AVF) as the best available access for hemodialysis<sup>3,5,6</sup>. Several techniques of anastomosis were defined in many years about creating AVF such as end-to-side, side-to-side, and end- to-end<sup>3,7,9</sup>. Regardless of the surgical technique, main aim of the surgery is to provide the flow patency as long as possible, without additional interventions. Early failure secondary to vasospasm and/or thrombus formation is the most seen etiologic factor of surgical failure<sup>3,5</sup>.

This study aims at analyzing the various factors affecting the clinical outcome of arteriovenous fistula done by the modified technique. It also aims to evaluate the outcome regarding patency, ease of access, and complications and to compare them with studies done with conventional technique of arteriovenous fistula.

#### Objective:

To compare the results of both surgical techniques for creation of arterio-venous fistula (AVF); End to side (ETS) versus Side to side (STS) artery techniques.

#### Material & Methods:

A single centre, Single surgeon Prospective randomized control trial study was carried out between May 2019 to June 2019, data of 50 patients, who underwent Arterio-venous Fistula (AVF) surgery secondary to end stage renal failure, who were selected randomly. Patients were divided into two groups. Group I was consisted of 25 patients to whom End to Side (ETS) technique was used. Group II (STS) was consisted the remaining 25 patient. Demographic data of patients, concomitant disorders, surgical side and locations, preoperative arterial and venous diameters were recorded.

Optimal condition of arteries and veins is crucial for access surgery. An optimal venous condition was defined as a good venous refill after its manual emptying. If superficial veins could not be visualized with a venous pressure tourniquet in place, or if any abnormality was noted on

the superficial venous examination, the patient was further evaluated with a superficial venous duplex ultra sound scan. Using venous duplex imaging, superficial veins were examined for their diameter, distensibility, and continuity. The minimal acceptable diameter for use was reported to be 2 to 3 mm, whereas optimal arteries had a three plus positive pulse as an essential criterion. If any abnormality was noted on the clinical arterial examination, the patient was further evaluated with segmental pressures and a duplex ultrasound scans or pause volume recordings. For optimal outcomes, no pressure gradient should have been noted between the bilateral upper extremities, the arterial diameter should have been greater than or equal to 2 mm throughout the extremity, and a patent palmar arch should have been present.

Dominant versus non-dominant upper extremities were chosen based on their vasculature status. Non dominant upper extremities were selected in identical conditions, while following conditions enforced AVF replacement in dominant upper extremities; unfavorable vessels, previously AVF replacement in non-dominant upper extremity, which is already out of order or same side subclavian temporary vascular access for hemodialysis. Prep and drep was done, followed by a linear incision to explore the arteries and veins of implantation site, while the peri operative systolic blood pressure was preserved at 100 mmHg.

In the STS group after obtaining control over the distal and proximal segments of the artery and vein, longitudinal arteriotomy and venotomy were performed and 10 mm side to side anastomosis was achieved. While in the ETS group, longitudinal arteriotomy was done, proximal end of the vein was anastomosed to the side of the artery using the end to side method. In cases where a good flow and thrill was not obtained, coronary dilators for dilatation of superficial veins and evaluation of the patency of veins before anastomosis was used. For prevention of Venous hypertension, distal venous ligation was performed.

Success in access surgery was defined when a good thrill was obtained whereas in the absence of thrill, hence an unsuccessful access replacement, excluded the patients from the trial. Post-surgery, a light bandage was done and all the precautionary for early AVF thrombosis and patency preservation were explained.

All patients were required for visits on the first postoperative day, when the patency of AVF was reviewed, i.e. whether it had thrill or not and

also the machinery murmur was auscultator. If any access had failed to mature, it was examined with a duplex ultrasound followed by venography if further information was necessary. The next visit was scheduled a month later and the final visits was appointed 6 months after the surgery. After initial maturation, the AV access was monitored routinely while the patient was on dialysis. The preferred method of monitoring was a monthly determination of access flow by the Doppler technique. Access flow less than 600 mL/min or access flow less than 1000 mL/min that had decreased by 25% over the past 4 months were evaluated with a duplex ultrasound followed by a fistulogram if further information was necessary.

**Statistical Analysis:** The data gathered during the 6 months follow up was registered in prepared forms and reviewed later to reach a statistical conclusion. The data were analyzed using Statistical Package for the Social Sciences version 20 (IBM Corp., IBM SPSS Statistics for Windows, Armonk, NY: USA). For evaluating the quantities variables, t-test was used while qualitative variables were measured using the chi-square and Fisher's exact tests.

### Results:

The present study included 50 Arterio-venous Fistula were created for hemodialysis from May 2019 to June 2019, who were divided into two groups of 25. In one group the venous artery anastomosing technique was End to Side (ETS) while in the other group the Side to Side (STS) anastomosing technique was used.

The overall median age was 48.00 (18.00 - 65.00) Yrs, median age was 50.00 (18.00 - 64.00) Yrs in group ETS and 42.00 (18.00 - 65.00) Yrs in group STS. Nine of patients were female in group ETS, while Eight of patients were female in group STS. 10 patients in group ETS, 9 patients in group STS had Diabetes Mellitus & 19 patients in group ETS, 13 patients in group STS had Hypertension history. In this study all the patients had anatomic & hematoma side. There were not any statistically significant differences on demographic data of patients (Table I).

**Table No. 1: Demographic & Co-morbidities Variables.**

	ETS	STS	P Value
Age			
10 - 20	2 (8.0%)	3 (12.0%)	0.407
20 - 30	3 (12.0%)	4 (16.0%)	
30 - 40	1 (4.0%)	4 (16.0%)	
40 - 50	19 (76.0%)	14 (56.0%)	
Sex (M/F)	16/9	17/8	0.765
Diabetes Mellitus	10 (40.0%)	9 (36.0%)	0.771
Hypertension	19 (76.0%)	13 (52.0%)	0.077

Although all the of the patients undergoing arterio-venous fistula (AVF) replacement had at least 1 complication, there were no significant differences in the overall rate of complications among the AVF in both the groups (Table 2). The most frequent complication was the Limb edema the AVF. This complication occurred with the highest frequency in the STS group (P = 0.564). All AVFs requiring superficialization were unable to be accessed for hemodialysis and so, by definition, were immature. Thus, superficialization contributed to assisted maturation in all AVFs in which it was performed. The second most common complication was thrombosis, which accounted for most of the failures to mature.

**Table No. 2: Complication of Arterio-venous Fistula in ETS & STS.**

Complication	ETS	STS	P Value
Limb Edema	9 (36.0%)	11 (44.0%)	0.564
Venous Hypertension	1 (4.0%)	3 (12.0%)	0.602
Thrombosis	3 (12.0%)	2 (8.0%)	0.637
Steal	0 (0.0%)	1 (4.0%)	0.312

After a 6 month duration of follow up, in 9 of the patients arterio-venous fistula (AVF) replacement was rendered not working. 4 of the failure cases occurred in the ETS group whereas 5 cases of arterio-venous fistula (AVF) replaced by the STS technique were unsuccessful. Failure of AVF in the STS group was explained to be a result of thrombosis and venous hypertension in 2 & 3 patients respectively.

### DISCUSSION:

There are various techniques for AVF surgery with several advantages and disadvantages. End- to-side anastomosis is recommended in many

studies<sup>3,4,6,9</sup>. It is notified as the highest proximal venous flow patency and a relatively low venous hypertension risk, when compared to other modalities<sup>3,5,6</sup>.

The creation of an arterio-venous fistula is an important activity that requires discipline for the quality of the patient's future lives. In some countries, a coordinated study has been conducted to establish the most successful arterio-venous fistula. In these countries, arterio-venous fistula is a professional surgical procedure that nephrologists, radiologists and surgeons organize and evaluate together<sup>10-12</sup>. The creation of fistulas should be given to a limited number of special surgeons because good results are only provided by surgeons who require specialization. All arterio-venous fistulas were created by senior surgeons in this study.

Distal arterio-venous fistula is still the gold standard access for hemodialysis. If these are not possible, middle arm and proximal arm arterio-venous fistulas should be always investigated before committing to proximal procedures. The upper arm fistulas potencies were significantly longer in the various studies than in the lower arm<sup>12</sup>.

The percentage of patients with Diabetes Mellitus in our study was 38.0% & Hypertension was 64.0%. In similar studies done by various authors<sup>13-16</sup>, on transposed brachio-cephalic & Radio cephalic fistula. Diabetes and Hypertension is the most important co-morbidity in patients of chronic kidney disease.

Hypertension is one of the most important factors that can cause vascular injury. Negative effects of hypertension on endothelial injury have been shown in the studies. The adverse effects on the arterio-venous fistula in hemodialysis patients have been proved in many studies<sup>17-19</sup>. However, in some studies, it was also said that it was negligible to affect the fistula patency<sup>20</sup>. It has been shown statistically that hypertension in our series affects the patency of the arterio-venous fistula, negatively. Gibson et al.<sup>21</sup> described an increased risk of revision in diabetic patients, a finding in line with our own observation. Diabetes mellitus may influence the formation of intimal hyperplasia at the anastomosis or venous valve. Manne et al.<sup>18</sup> published an article that suggests that diabetes does not affect fistula patency<sup>19</sup>. In our study, diabetes mellitus was found in 19 (38.0%) of patients. This had an effect on the fistula patency. But no difference was found between the patency rates of the arterio-venous fistula over the both group.

### CONCLUSION:

Finally, our data analysis showed that some risk factors, such as age, diabetes mellitus, hypertension, Limb Edema and Thrombosis patency. Although comparing the result of the two groups with two different techniques of AVF replacement during a follow up of 6 months, we can perhaps declare that there was no significant difference in failure rates among the two groups to gain a permanent hemodialysis vascular access. Nevertheless the possibility of reaching different results with longer duration follow ups should not be ruled out and this extra follow up time will definitely help reaching a better insight regarding the AVF patency and access longevity.

### REFERENCES

- Ziabakhsh Tabary SH, Fazli M. Clinical outcome of coronary artery bypass grafting (CABG) in hemodialysis dependent patients and comparison with non-renal failure patients. *Eur Rev Med Pharmacol Sci* 2013; 17: 2628-2631.
- Ozhasenekler A, Gokhan S, Guloglu C, Orak M, Ustundag M. Benefit of hemodialysis in carbamazepine intoxications with neurological complications. *Eur Rev Med Pharmacol Sci* 2012; 16: 43-47.
- Kadan M, Karabacak K, Kaya E, Erol G, Doganci S, Yildirim V, Demirkilic U. New probing and warm washing technique in arteriovenous fistula surgery: early results of a single center. *Turk J Vasc Surg Epub Ahead of print* DOI: 10.9739/uvcd.2015-45186.
- Mozaffar M, Fallah M, Lotfollahzadeh S, Sobhiyeh MR, Gholizadeh B, Jabbehdari S, Mahdi Z. Comparison of efficacy of side to side versus end to side arteriovenous fistula formation in chronic renal failure as a permanent hemodialysis access. *Nephro urol Mon* 2013; 5: 827-830.
- Hong SY, Yoon YC, Cho KH, Lee YH, Han IY, Park KT, Ko SM. Clinical analysis of radio-cephalic fistula using side-to-side anastomosis with distal cephalic vein ligation. *Korean J Thorac Cardio-vasc Surg* 2013; 46: 439-443.
- Jennings WC, Taubman KE. Alternative autogenous arteriovenous hemodialysis access options. *Semin Vasc Surg* 2011; 24: 72-81.
- Rose DA, Sonaike E, Hughes K. Hemodialysis access. *Surg Clin North Am* 2013; 93: 997-1012.
- Miller GA, Hwang WW. Challenges and management of high-flow arteriovenous fistulae. *Semin Nephrol* 2012; 32: 545-550.
- Stanziale R, Lodi M, D'andrea E, Sammartino F, Di Iuzio V. Arteriovenous fistula: end-to-end or end-to-side anastomosis? *Hemodial Int* 2010; 15: 100-103.
- Zibari GB, Rohr MS, Landreneau MD, Bridges RM, DeVault GA, Petty FH, et. al. Complications from permanent hemodialysis vascular access surgery. 1988; 104 (4): 681 - 6.
- Chazan JA, London MR, Pono LM. Long-term survival of vascular accesses in a large chronic hemodialysis population. *Nephron*. 1995; 69 (3): 228 - 33.

12. Dixon BS, Novak L, Fangman J. Hemodialysis vascular access survival: Upper arm native arteriovenous fistula. *Am J Kidney Dis.* 2002; 39(1): 92 - 101.
13. Sahasrabudhe P, Dighe TA, Ambekar N, Panse N, Deshpande S, Londhe S, Rathod J, Pradhan M, Vajed M. Study of efficacy and functionality of modified technique of proximal arteriovenous fistula as a vascular access for hemodialysis: A retrospective analysis of 171 cases. *Med J DY Patil Vidyapeeth* 2019;12:139-44.
14. Lee CH, Ko PJ, Liu YH, Hsieh HC, Liu HP. Brachio basilic fistula as a secondary access procedure: An alternative to a dialysis prosthetic graft. *Chang Gung Med J* 2004; 27: 816 -23.
15. Maya ID, O'Neal JC, Young CJ, Barker-Finkel J, Allon M. Outcomes of brachiocephalic fistulas, transposed brachio basilic fistulas and upper arm grafts. *Clin J Am Soc Nephrol* 2009; 4: 86 -92.
16. Koksoy C, Demirci RK, Balci D, Solak T, Kose SK. Brachio basilic versus brachiocephalic arteriovenous fistula: A prospective randomised study. *J Vasc Sure* 2009; 49: 171 - 7.
17. Green KB, Silverstein RL. Hypercoagulability in cancer. *Hematol Oncol Clin North Am.* 1996; 10: 499 - 530.
18. Manne V, Vaddi SP, Reddy VB, Dayapule S. Factors influencing patency of bresciacimino arteriovenous fistulas in hemodialysis patients. *Saudi j kidney Dis Transpl.* 2017; 28(2): 313 - 17.
19. Farber A, Tan TW, Hu B, Dember LM, Beck GJ, Dixon BS, et.al. Dialysis access consortium (DAC) study group; dialysis access consortium DAC study group. The effect of location and configuration on forearm and upper arm hemodialysis arteriovenous grafts. *J Vasc Sure.* 2015; 62 (5): 1258 - 64.
20. Astor BC, Coresh J, Powe NR, Eustace JA, Klag MJ. Relation between gender and vascular access complications in hemodialysis patients. *Am J Kidney Dis.* 2000; 36 (6): 11226 - 34.
21. Gibson KD, Gillen DL, Caps MT, Kohler TR, Sherrard DJ, Stehman Breen CO. Vascular access survival and incidence of revision: A comparison of prosthetic grafts, simple autogenous fistulas, and venous transposition fistulas from the United States renal data system dialysis morbidity and mortality study. *J Vasc Sure.* 2001; 34 (4): 694 - 700.