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Original Research Article

Impact of Vascular Access type on Health- Related Quality of Life in Patients Undergoing Hemodialysis- A Cross- Sectional Observational Study.

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Abstract

Objective: Patients undergoing hemodialysis (HD) have a poor health-related quality of life (HRQOL). HRQOL may differ across geography and ethnicity. This study aimed to compare HRQOL in patients undergoing HD by arteriovenous fistula (AVF) and central venous catheter (CVC) in a cohort of Indian population. Methods: This was a cross-sectional observational study conducted between February 2021 and March 2021. All patients undergoing HD (more than 1 month) who had vascular access using AVF or CVC were eligible to participate in the study. Sociodemographic characteristics were noted, and HRQOL was assessed using the Short Form 36 questionnaire. Results: A total of 129 patients were included in this study, 33 in CVC group and 96 in AVF group, without any crossover. The mean (SD) age was 49.84 (14.86), and 83 (64.3%) patients were male and the median (range) duration of HD was 14 months (2 months–120 months). Overall, patients who underwent AVF for vascular access had significantly ($p < 0.05$) higher HRQOL score than those who underwent CVC. There was no significant difference of HRQOL score for majority of the parameters for gender, frequency and duration of HD. Conclusions: Overall, results showed that patients who had vascular access using AVF showed better HRQOL as compared to CVC in patients with HD.

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Keywords: Arterio-venous Fistula, Central Venous Catheter, Health-Related Quality of Life, Hemodialysis, Vascular Access

Introduction

Dialysis is one of the treatment modalities that allows a patient with end stage organ failure to live a long, healthy and productive life. Chronic kidney disease currently affects around 850 million people worldwide. Our body continuously produces the "wastes" which in normal functioning kidneys gets removed via urine, however in chronic kidney disease patients it accumulates and if not removed leads to serious health implications, so dialysis must be repeated at regular intervals. It is estimated that about 200,000 new patients develop end-stage kidney failure every year in India. While only 40% of them actually start dialysis. Many of these patients are young, in the prime of their lives - family breadwinners or homemakers. So, a loss of these people has devastating impact not only on the families but also brings down the productivity of entire society and reduces the national income [1]. End-stage renal disease (ESRD) is one such chronic disease that causes a high level of disability in different domains of the patients' lives, leading to impaired QOL[2]. Hemodialysis therapy is time intensive, expensive, and requires fluid and dietary restrictions. Long-term dialysis therapy itself often results in a loss of freedom; dependence on caregivers; disruption of marital, family, and social life; and reduced or loss of financial income[3].

There are three major vascular access types used for hemodialysis procedure : Arteriovenous fistula (AVF), permanent catheter (PC), and vascular graft [4]. Amongst them, AVF is preferred over the other because of lower risk of infection and thrombosis.[5,6]

Longer access survival rate, shorter hospitalization, and less mortality and morbidity have also been reported in patients with AVF.[7,8] However, in some patients with comorbidities like diabetes mellitus, heart failure, peripheral vascular disease, obesity or elderly patients, insertion of AVF is difficult or contraindicated, therefore in these patients, insertion of tunneled cuff catheters may be the preferred method.[9,10,11] The most serious and life-threatening complication of permanent catheters (PCs) is infection- exit site infection, tunnel infection and bacterimia-septicemia due to the intraluminal route of infection.[12,13]. Multiple studies have demonstrated that AVF is associated with reduced incidence of infection, thrombosis and decreased morbidity and mortality than CVC or AVG.[7,14,15,16]. Though, recommended form of vascular access for patients with ESRD, impact of AVF on patient perception of health status, quality of life (QOL), or satisfaction is unknown. It is also known that patients undergoing HD have a poor health related quality of life (HRQOL) as compared to the normal population. In addition, HRQOL is also associated with the mortality in patients with ESRD; however, there are very few studies that assessed the association of HRQOL with types of vascular access in patients with ESRD. Moreover, the reported HRQOL may differ from population to population and across ethnic groups. The questionnaire used in this study, KDQOL-SF Tm , is a multidimensional, reliable and validated instrument specially designed for dialysis patients and has as its generic core the 36-item Short Form Health Survey (SF-36) [17].

Objective of our study-

To compare HRQOL in patients who are undergoing HD by AVF and CVC in a cohort of Indian population and which method is better for hemodialysis.

Methodology:

Study design- Observational Cross sectional study.

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Sample size- 100
Study participants- All ESRD patients undergoing maintenance intermittent HD. All the study patients were under regular nephrological care and had a consultation with the nephrologist once at least every 30 days, with required laboratory investigations and change of medication accordingly. The vascular access were achieved using one of the two options (AVF or CVC). All the patients with AVF were being dialyzed from a matured AVF for at least 1 month.

Inclusion criteria- All ESRD patients undergoing maintenance intermittent HD each session lasting for 4 h duration on twice or thrice per week schedule (more than 1 months) using standard dialysate at the same dialysis unit (Shree Krishna Hospital's dialysis unit).

Exclusion criteria- Patients who had prior limb amputation, known history of malignancy, active liver disease, and left ventricular ejection fraction <15% were excluded from the study. Patients with catheter-related bloodstream infection in the past 1 month were excluded, as there may be a possibility of reinfection and reporting poor quality of life in these patients. However, patients with a history of multiple access failures were not be excluded from the study
Place of the study- Dialysis Unit of Shree Krishna hospital, Pramukhswami Medical College, Karamsad, Anand, Gujarat
Period- January 2021-February 2021
We conducted a cross-sectional study of community-dwelling prevalent HD patients using validated questionnaires to assess patient satisfaction with their dialysis access as well as HRQOL.. The study protocol was reviewed and approved by the institutional ethics committee. The study was conducted in accordance with the principles that have their origin in the Declaration of Helsinki, the good clinical practice, and the approved protocol. Sociodemographic characteristics were noted including age, sex, whether living with family or with a partner, educational details, marital status, monthly income, coronary artery disease, and cerebrovascular disease (CVD). Laboratory parameters including blood glucose level, hemoglobin, serum albumin, serum creatinine, electrolytes, were assessed. Assessment of HRQOL was done by using the Short Form 36 (SF-36) questionnaire. This well-validated QOL questionnaire consists of 36 items and 8 subscales: physical functioning, physical role, pain, general health, vitality, social functioning, emotional role, and mental health. These eight subscales can then be summarized into two primary dimensions of functioning. These are the physical component summary score (PCS) and mental component summary score (MCS). For both summary scores, higher scores indicated increased QOL. The SF-36 has been validated in patients with end-stage renal disease and patient with chronic condition like cancer. This questionnaire includes 36 questions which are scored between 0 and 100. Higher the score better is QoL. For the present study the questionnaire was translated into Guajarati language & has been validated by two independent Nephrologists other than this institute.
Statistical Analysis Descriptive characteristics were reported using means (standard deviations [SDs]) or as number (percentages). Unpaired student 't' test was used for comparison of two or more groups. Power of the study was kept at 85% with $P<0.05$ considered statistically significant.

Result:
A total 129 patient, 33 in CVC group and 96 in AVF group, were included in this study. The mean (SD) age was 49.84 (14.86), and 83 (64.3%) patients were male [Table 1]. One hundred thirteen (87.6%) patients were married. Hypertension (82.9%) was the most common co-morbidity among ESRD patients. A total of 107 (82.9%) patients had a history

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of hypertension, 79 patients (69.2%) had diabetes mellitus, 14 patients (10.9%) had history of CAD, 3 patients (2.3%) had Cerebro vascular event. Total 17 (13.2%) patients were unemployed. Only 5 (3.9%) patients were illiterate, all other were received at least their primary school education. [Table 1]

Overall, results showed that patients with AVF for vascular access had significantly ($P < 0.05$) higher HRQOL score than those who underwent CVC. Most of the HRQOL domains (physical functioning, role physical limitation, energy and fatigue) and both the summary scores (PCS and MCS scores) were significantly higher for patients who underwent AVF for vascular access [Table 2].

Similarly, for patients with age group ≤35 Years of age had significantly higher score for physical functioning and PCS ($P < 0.05$) [Table 2].
Overall, there was no statistically significant difference in the HRQOL between male and female patients in the majority of components ($P > 0.05$), The scores for energy and fatigue were slightly higher for males (75.42 vs. 70.58); however, the difference was not significant. Overall, both the summary scores (PCS and MCS scores) showed no difference between males and females [Table 2].

Duration of HD had no statistical significance in any domains ($P > 0.05$), The scores for energy and fatigue were slightly higher for patients who had duration of HD is less (76.95 vs. 70.95). Similarly, Frequency of HD had no statistical significance in any domains ($P > 0.05$), The score of Role of physical limitation and social functioning were decreased as frequency of HD per week is increase. Overall, both the summary scores (PCS and MCS scores) and HRQOL showed no difference between age groups and duration of HD and Frequency of HD [Table 3].

Table 1: Basic Demographic Details of all patients

Parameter	***n*=129**	**CVC (33)**	**AVF (96)**
Age (years), mean (SD)	49.84(14.86)	51.14(13.80)	49.51(15.08)
Age Group			
≤ 35 Years	25 (19.4)	5	20
35-60 Years	66 (51.2)	19	47
≥ 61 Years	38 (29.5)	9	19
Male	83 (64.3)	20	63
Female	46 (35.7)	13	33
Living with family	40 (31)	10	30
Living with partner	89 (69)	23	66
Medical history			
Hypertension	107 (82.9)	22	85
Diabetes mellitus	79 (61.2)	17	62
CAD	14 (10.9)	4	10
Cerebrovascular events	3 (2.3)	3	0
Educational status			
Illiterate	5 (3.9)	1	4
Primary school	49 (38)	15	34
Secondary school	29 (22.5)	11	18
High school	21 (16.3)	4	17
University	25 (19.4)	2	23
Monthly income	20 (15.5)	1	19
(>10,000 INR)	109(84.5)	32	77

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Monthly income (≤10,000 INR)	17 (13.2)	6	11
Occupation	10 (7.8)	2	8
Unemployed	15 (11.6)	2	13
Student	10 (2.3)	0	3
Businessman	4 (3.1)	1	3
Job	37 (28.7)	10	27
Retired	2 (1.6)	0	2
Farmer	41 (31.8)	12	29
Teacher			
Housewife			

Data presented as n (%), unless otherwise specified.
CAD: Coronary artery disease, HD: Hemodialysis, SD: Standard deviation, CVC: Central venous catheter, AVF: Arteriovenous fistula

Table 2: Comparison of HRQOL scores according to vascular access, Gender and Age groupsData presented as mean (SD)

Parameters	**Vascular Access ***		**Gender**		**AGE #**		
	AVF (96)	**CVC (33)**	**Female (46)**	**Male (83)**	**≤35 Years**	**35-60 Years**	**>61 Years**
Physical functioning	**67.56 (23.54)**	**60.61 (25.70)**	65.00 (24.03)	66.22 (24.43)	**85.80 (14.97)**	**63.88 (22.72)**	**55.92** (24.43)
Role physical limitation	**55.00 (41.64)**	**37.42 (43.12)**	48.91 (43.44)	51.39 (42.29)	70.00 (40.18)	46.74 (41.18)	44.21 (43.76)
Pain	90.83 (13.76)	84.98 (20.93)	88.53 (16.71)	89.78 (15.71)	94.50 (10.50)	89.38 (14.73)	85.86 (20.07)
General health	88.44 (15.10)	82.27 (18.37)	86.52 (16.01)	87.05 (16.32)	91.60 (14.84)	84.92 (16.92)	87.11 (15.31)
Health Change	91.09 (18.11)	91.67 (17.30)	91.74 (15.81)	90.96 (18.95)	95.00 (16.13)	91.59 (16.57)	88.16 (20.74)
Role emotional limitation	90.21 (23.23)	82.83 (29.02)	88.26 (24.71)	88.35 (25.20)	93.34 (21.51)	88.28 (22.37)	85.08 (30.71)
Energy and fatigue	**75.12 (20.85)**	**69.55 (23.19)**	70.58 (23.09)	75.42 (20.54)	**85.60 (20.68)**	**69.34 (20.14)**	**73.42 (21.96)**
Emotional well-being	83.09 (20.05)	77.82 (24.12)	78.89 (23.89)	83.33 (19.51)	88.32 (19.83)	78.56 (21.46)	82.95 (20.99)
Social functioning	76.79 (22.24)	75.76 (22.73)	75.02 (22.36)	77.36 (22.33)	85.34 (18.17)	75.20 (22.94)	73.03 (22.61)
PCS score	**78.59 (14.17)**	**71.39 (17.30)**	76.14 (14.89)	77.08 (15.59)	**87.38 (14.78)**	**75.30 (13.27)**	**72.25 (16.03)**
MCS score	**78.39 (15.56)**	**73.62 (18.10)**	75.15 (17.21)	78.29 (15.79)	86.66 (15.89)	74.60 (14.91)	75.41 (17.03)
HRQOL	**78.49 (14.00)**	**72.50 (16.71)**	75.65 (16.16)	77.68 (14.80)	**87.02 (14.83)**	**74.95 (12.76)**	**73.83 (15.95)**

*p< 0.05 for physical functioning, role of physical limitation, energy fatigue,
#p = 0.05 for energy and fatigue and #p <0.01 for Physical functioning. AVF: Arteriovenous fistula, CVC: Central venous catheter, PCS: Physical component summary, MCS: Mental component summary, SD: Standard deviation

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Table 3: Comparison of HRQOL scores according to duration of HD and Frequency of HD per week.Data presented as mean (SD)

Parameters	Duration of HD		Frequency of HD	
	≤1 Year	>1 Year	≤2 Per Week	>2 Per Week
Physical functioning	67.31 (22.25)	64.50 (25.82)	67.17 (22.60)	64.82 (25.36)
Role physical limitation	51.69 (42.51)	49.50 (42.87)	**58.21 (40.10)**	**45.13 (43.64)**
Pain	89.09 (17.81)	89.55 (14.47)	86.93 (17.18)	91.01 (15.05)
General health	87.54 (15.43)	86.29 (16.82)	86.70 (14.17)	86.97 (17.49)
Health Change	90.25 (19.70)	92.07 (16.20)	90.57 (16.42)	91.71 (18.86)
Role emotional limitation	87.57 (26.19)	88.95 (23.99)	90.19 (20.83)	86.32 (27.39)
Energy and fatigue	**76.95 (19.65)**	**70.95 (22.76)**	73.49 (19.45)	73.84 (22.98)
Emotional well-being	82.10 (21.92)	81.44 (20.71)	83.02 (19.57)	80.86 (22.34)
Social functioning	77.90 (21.50)	75.37 (23.01)	**80.11 (18.50)**	**74.03 (24.39)**
PCS score	77.17 (15.94)	76.39 (14.82)	77.92 (13.40)	75.93 (16.52)
MCS score	78.52 (17.24)	76.03 (15.52)	78.63 (14.73)	76.16 (17.35)
HRQOL	77.85 (15.87)	76.21 (14.11)	78.27 (13.31)	76.04 (15.95)

Discussion:

Quality of life is being increasingly recognized as one of the key outcome parameters in any medical and interventional treatment. Hemodialysis (HD) is the most common modality of treatment chosen amongst patients with end stage renal disease due to shortage of live donors and lack of national cadaver program for kidney transplant. Hemodialysis alters the lifestyle of the patient and family also. The major areas of life affected by ESRD and its treatment include employment, food, travel, sense of security, self-esteem, social relationships, and the ability to enjoy life. Owing to these reasons, the physical, psychological, socioeconomic, and environmental aspects of life are negatively affected, leading to compromised QOL. Survival of patients with ESRD has been largely improved nowadays because of advances in HD technology and better patient care. Recent data shows that health-related quality of life (HRQOL) markedly influences dialysis outcomes. Attention thus needs to be focused not only on how long but also on how well patients with ESRD live. Compared with the general population, patients with ESRD treated with hemodialysis have significantly impaired HRQOL [18].

Vascular accesss is the key to efficacy of HD. Adequate vascular access contributes to the efficiency of HD and may reduce mortality and morbidity in patients with ESRD.[19] Hemodialysis prolongs life for patients with end-stage kidney disease, but complications of vascular access contribute to 15%-20% of hospitalizations in patients on hemodialysis therapy and are associated with increased morbidity and mortality.[20]] If a vascular access with better HRQOL is available, this could improve patient's health status and improve the benefit from treatment. The AVF is considered a gold standard vascular access type for HD because of its less infectious complications, longer patency, and low mortality and morbidity, which translates into better HRQOL.[21] However, Late referral and delayed creation of vascular access may be due in part to patient refusal and fears of dialysis and also are

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associated with increased risk of complications. A meta analysis, which included 318 studies with more than 62,000 vascular accesses, showed that AVF was at high risk of maturation failure and abandonment. This study showed that by 6 months, only 26% of AVFs were mature and 21% were abandoned.[22]. In our Cross sectional study, AVF have better MCS and PCS as compared to CVC reflecting greater exercise capacity and fewer limitations in physical activity. In patients undergoing HD, factors contributing to reduced physical activity include anemia of chronic disease and uremic myopathy.[23] Since AVF had better dialysis adequacy, there are reduced chances of anemia and uremia.[24] In CVC patients, there is a reduced PCS probably due to reduced blood flow, recirculation, catheter thrombosis, infection, anemia, and erythropoietin resistance.[24] Similar findings were observed in a study by Dhingra et al. who reported that patients with AVF in ESRD were more ambulatory than patients with CVC.[25]

In the present study, we did not find any significant difference in the HRQOL among males and females; however, females showed slightly poor QoL as compared to male patients. The reason for better QoL in males in India could probably be due to better social relationships and support from family and friends as compared to females. A similar observation was made by Santos et al. [26]

In the present study, patients below the age groups of <35 years showed better HRQOL, probably as age increases patients may have other comorbidities, slower recovery, financial dependence, and lack of care and support from family.

Duration of HD and Numbers of HD per week did not showed any significant difference in the HRQOL, However score of social functioning and role physical limitation are less as number of HD per week is increased.

Education and monthly income level may not affect HRQOL directly, but literate patients might have a better acceptance about the treatment options and, as patients with higher income have a lesser financial burden in taking dialysis and managing medical emergencies, which does improve the HRQOL as compared to other patients. Similar results were found in another study by Seica et al. [27]

This observational study cannot directly address the mechanisms by which venous catheters may be related to a higher risk for mortality. Several potential mechanisms, however, have been proposed:

a. Catheters provide a lower blood flow rate; therefore, a lower dialysis dose may be achieved (28).

b. The increased rate of access-related complications may result in more missed or shortened dialysis sessions. This again may lead to a lower dialysis dose, more frequent hospital admissions, and other untoward effects [29].

c. The higher risk for mortality in patients with a venous catheter also may be a direct result of access infections and septicemia, which are much more common in catheters than AV accesses [30]

Conclusions: Overall, results showed that patients with AVF had better HRQOL as compared to CVC in patients with End stage renal disease (ESRD) on HD. This could help clinicians' better council patients requiring access for HD.

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References:

1. Jha V. Dialysis in India – Today and Tomorrow. Available rom:https://health.economictimes.indiatimes.com/healthfiles/dialysisinindiatodayan tomorrow/1233.
2. Alshraifeen A, McCreaddie M, Evans JM. Quality of life and well-being of people receiving haemodialysis treatment in Scotland: a cross-sectional survey. Int J Nurs Pract 2014; 20:518–523. Back to cited text no. 2
3. Mandoorah QM, Shaheen FA, Mandoorah SM, Bawazir SA, Alshohaib SS. Impact of demographic and comorbid conditions on quality of life of hemodialysis patients: a cross-sectional study. Saudi J Kidney Dis Transpl 2014; 25:432–437. Back to cited text no. 3
4. Karkar A, Chaballout A, Ibrahim MH, Abdelrahman M, Al Shubaili M. Improving arteriovenous fistula rate: Effect on hemodialysis quality. Hemodial Int 2014;18:51621
5. Robbin ML, Chamberlain NE, Lockhart ME, Gallichio MH, Young CJ, Deierhoi MH, et al. Hemodialysis arteriovenous fistula maturity: US evaluation. Radiology. 2002;225:59–64
6. Allon M, Robbin ML. Increasing arteriovenous fistulas in hemodialysis patients: Problems and solutions. Kidney Int. 2002;62:1109–24
7. Misra M. The basics of hemodialysis equipment. Hemodial Int. 2005;9:30–6.
8. Hirth RA, Turenne MN, Woods JD, Young EW, Port FK, Pauly MV, et al. Predictors of type of vascular access in hemodialysis patients. JAMA. 1996;276:1303–8.
9. Ifudu O, Macey LJ, Homel P, Hyppolite JC, Hong J, Sumrani N, et al. Determinants of type of initial hemodialysis vascular access. Am J Nephrol. 1997;17:425–7.
10. Coli' L, Cuna V, Capelli I, Kwin C, Donati G, La Manna G, et al. When native arteriovenous fistula is not possible: The permanent catheter is better. G Ital Nefrol. 2009;26:154–7.
11. Allon M. Dialysis catheter-related bacteremia: Treatment and prophylaxis. Am J Kidney Dis. 2004;44:779–91
12. Stevenson KB, Hannah EL, Lowder CA, Adcox MJ, Davidson RL, Mallea MC, et al. Epidemiology of hemodialysis vascular access infections from longitudinal infection surveillance data: Predicting the impact of NKF-DOQI clinical practice guidelines for vascular access. Am J Kidney Dis. 2002;39:549–55
13. Tanriover B, Carlton D, Saddekni S, Hamrick K, Oser R, Westfall AO, et al. Bacteremia associated with tunneled dialysis catheters: Comparison of two treatment strategies. Kidney Int. 2000;57:2151–5.
14. Smits JH, van der Linden J, Blankestijn PJ, Rabelink TJ. Coagulation and haemodialysis access thrombosis. Nephrol Dial Transplant. 2000;15:1755–60
15. Knoll GA, Wells PS, Young D, Perkins SL, Pilkey RM, Clinch JJ, et al. Thrombophiliazand the risk for hemodialysis vascular access thrombosis. J Am Soc Nephrol. 2005;16:1108–14.
16. A. Johansen KL, Painter P, Kent-Braun JA, Ng AV, Carey S, Da Silva M, et al. Validation of questionnaires to estimate physical activity and functioning in end-stage renal disease. Kidney Int 2001;59:1121-7
17. Hays RD, Kallich JD, Mapes DL, et al.Development of the kidney disease quality of life

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(KDQOL Tm) instrument. Qual Life Res 1994; 3: 329±338
18. Molsted S, Aadahl M, Schou L, Eidemak I. Self-rated health and employment status in chronic hemodialysis patients. Scand J Urol Nephrol 2004; 38:174–178. Back to cited text no. 6
19. Karkar A, Chaballout A, Ibrahim MH, Abdelrahman M, Al Shubaili M. Improving arteriovenous fistula rate: Effect on hemodialysis quality. Hemodial Int 2014;18:51621
20. Feldman H, Held P, Hutchinson J, Stoiber E, Hartigan M, Berlin J. Hemodialysis vascular access morbidity in the United States. Kidney Int. 1993;43(5):1091-1096.
21. Polkinghorne KR, McDonald SP, Atkins RC, Kerr PG. Vascular access and allcause mortality: A propensity score analysis. J Am Soc Nephrol 2004;15:47786
22. Bylsma LC, Gage SM, Reichert H, Dahl SL, Lawson JH. Arteriovenous fistulae for haemodialysis: A systematic review and metaanalysis of efficacy and safety outcomes. EurJVasc Endovasc Surg 2017;54:51322.
23. Johansen KL. Physical functioning and exercise capacity in patients on dialysis. Adv Ren Replace Ther 1999;6:1418.
24. Sehgal AR, Snow RJ, Singer ME, Amini SB, DeOreo PB, Silver MR, et al. Barriers to adequate delivery of hemodialysis. Am J Kidney Dis 1998;31:593601
25. Dhingra RK, Young EW, HulbertShearon TE, Leavey SF, Port FK. Type of vascular access and mortality in U.S. Hemodialysis patients. Kidney Int 2001;60:144351.
26. Santos PR, Daher EF, Silva GB Jr., Libório AB, Kerr LR. Quality of life assessment among haemodialysis patients in a single centre: A 2-year follow-up. Qual Life Res 2009;18:541-6. Back to cited text no. 17
27. Seica A, Segall L, Verzan C, Văduva N, Madincea M, Rusoiu S, et al. Factors affecting the quality of life of haemodialysis patients from Romania: A multicentric study. Nephrol Dial Transplant 2009;24:626-9.
28. Fan PY, Schwab SJ: Vascular access: Concepts for the 1990s [Editorial]. J Am Soc Nephrol **3** : 1 –11, 1992
29. Feldman HI, Held PJ, Hutchinson JT, Stoiber E, Hartigan MF, Berlin JA: Hemodialysis vascular access morbidity in the United States. Kidney Int 43 : 1091 –1096, 1993
30. Powe NR, Jaar B, Furth SL, Hermann J, Briggs W: Septicemia in dialysis patients: Incidence, risk factors, and prognosis. Kidney Int **55** : 1081 –1090, 1999