

Hemodialysis Angioaccess Choice and Survival in a Tertiary Care Saudi Arabian Center from 1993 to 2004

Saad Al Shohaib¹, Abdelkarim Waness^{2*}, Abdulla Al Sayyari³

¹Division of Nephrology, King Abdulaziz University Hospital, Jeddah, Saudi Arabia

²Division of Internal Medicine, King Abdulaziz Medical City, Riyadh, Saudi Arabia

³Division of Nephrology, King Abdulaziz Medical City, Riyadh, Saudi Arabia

Abstract

Background and Aims: Properly functioning angioaccess is essential for the provision of adequate dialysis. We present and discuss a unique vascular access experience in a Saudi Arabian Center, lasting for more than ten years.

Methods: We prospectively studied all patients with end stage kidney disease, who underwent any of three vascular access procedures (cuffed central venous catheter, arteriovenous graft, or arteriovenous fistula) from 1993 to 2004 with the objective of assessing the relative rates among these three forms of angioaccess and the survival rates of arteriovenous fistula and its relation with patients' gender, weight or nationality. The survival rate of the AVF as defined by the fistula patency rate was divided into three categories: short-term patency (early AVF failure in: less than 6 weeks), medium-term patency (6 to 52 weeks) and long-term patency (more than 52 weeks).

Results: There were 603 patients (386 males and 217 females). The mean age was 48.5 years (SD \pm 18.6). 326 patients were Saudis. The cause of ESRD was diabetes mellitus in 275 patients, glomerulonephritides in 170 patients and hypertension in 158 patients. The mean BMI was 29 (SD \pm 3.7). 580 of the patients had arteriovenous fistula (AVF), 44 had arteriovenous graft (AVG), and 35 patients received only central venous catheter. There was a high early failure rate of AVF 46.4%, particularly in females (61.5%, $p=0.0001$) and non Saudis (55%, $p=0.0008$). The long-term patency rate (> 52 weeks) was 38.8 % with no differences seen between genders or nationalities. BMI did not have an effect on AVF survival. The incidence of other complications combined was only 5.3%.

Conclusion: The vast majority of angioaccess was AVF in keeping with NKF-DOQI guidelines. There was a high early AVF failure rate in women and non-Saudis. Diabetes mellitus seems to be a strong contributing factor but not other renal disease etiologies. Further research is needed in this field in Saudi Arabia.

Keywords: End Stage Renal Disease, Hemodialysis, Central Venous Catheter, Native Arteriovenous Fistula, Arteriovenous Graft.

Introduction

The rate of End Stage Renal Disease (ESRD) is increasing in the Kingdom of Saudi Arabia (1). Hemodialysis remains the main form of treatment available for patients with ESRD. There are three forms of angioaccess used to perform chronic hemodialysis:

*Correspondence:

Abdelkarim Waness, MD
Consultant, Division of Internal Medicine
King Abdulaziz Medical City
Department of Medicine, Code # 1443
PO Box 22490, Riyadh 11465, Saudi Arabia
Tel: 966-1-252-0088 ext: 14187
Fax: 966-1-252-0088 ext: 14229
E-Mail: n4a1w@yahoo.com
Received: 16 Jan 2010
Revised: 18 Mar 2010
Accepted: 30 Mar 2010

cuffed central venous catheter, arteriovenous graft and arteriovenous fistula. In this paper, we report the results of a ten-year experience of a Saudi tertiary medical center in the field of vascular access for patients with ESRD.

Materials and Methods

We prospectively followed 603 patients with end stage kidney disease, who underwent any of the three vascular access procedures (cuffed central venous catheter, arteriovenous graft, or arteriovenous fistula) from 1993 to 2004. We looked into their age, gender, cause of their ESRD, and body mass index (BMI) with the object of assessing the relative rates among these three forms of angioaccess and the survival rates of arteriovenous fistula and its relation with patients' gender, weight or nationality.

Most patients had temporary catheters, mostly femoral and few jugular on the opposite side, prior to the placement of AVF. We implemented the recommendation of placing AVF when serum creatinine level reached 4 mg /dl. However, most AVF were

done late due to late referral or patients' refusal. All procedures were done by vascular surgeons. The first interval for using fistula is 6 weeks on average.

The survival rate of the AVF, as defined by the fistula patency rate, was divided into three categories: short-term patency (early AVF failure in: less than 6 weeks), medium-term patency (6 to 52 weeks) and long-term patency (more than 52 weeks). This study was pre-approved by our local ethics committee.

Statistics

Statistical analysis was done by the SPSS (version 17.0) software program with the assistance of a statistician. We calculated the percentage of those who survived for 6 weeks and those who survived for 52 weeks. Then the association of survival and gender for example was done by the Chi-squared test. A p value less than 0.05 was considered significant.

Results

Of our 603 patients, 64% were males and 54% were Saudis. The mean age was 48.5 years.

Table 1: Baseline Characteristics of the Study Patients

Number of Patients	603
Mean age – yr	48.5 (SD ± 18.6)
Gender: Female/Male– no. (%)	217 (36%) / 386 (64%)
Nationality:Saudi/Non-Saudi – no. (%)	326 (54%) / 277 (46%)
Cause of ESRD: DM/HTN/GN – no. (%)	275 (45.6%)/158 (26.2%)/170 (28.2%)
Mean Body Mass Index [BMI]	29.0 (SD ± 3.7)
- BMI less than 30 – no. (%)	350 (58%)
- BMI 30 or more – no. (%)	253 (42%)
Central Venous Catheter [CVC] – no. (%)	35 (5.8%)
- Saudi / Non-Saudi – no. (%)	16 (2.6%) / 19 (3.2%)
Arteriovenous Graft [AVG] – no. (%)	44 (7.3%)
- Saudi / Non-Saudi – no. (%)	22 (3.65%) / 22 (3.65%)
Arteriovenous Fistula [AVF] – no. (%)	580 (96.1%)
- Saudi / Non-Saudi – no. (%)	320 (53.0%) / 260 (43.1%)
AVF Survival (total)	
- Less than 6 weeks	268 (46.4%)
- 6 weeks – 52 weeks	103 (17.8%)
- More than 52 weeks	207 (38.8%)

Table 2: AVF failure rates related to gender, weight and nationality

	Males	Females	BMI < 30	BMI ≥ 30	Saudi	Non-Saudi
Short term (0-6weeks)	148 (38.6%)	120 (61.5)	150 (44.4%)	118 (49.2%)	125 (39.3%)	143 (55.0%)
Medium term (6-52weeks)	83 (21.7%)	20 (10.3%)	64 (18.9%)	39 (16.3%)	66 (20.8%)	37 (14.2%)
Long term (> 52weeks)	152 (36.7%)	55(28.2%)	124 (36.7%)	83 (34.6%)	127 (39.9%)	80 (30.8%)
P-value	<0.0001		0.49		0.0008	

The causes of ESRD were: diabetes mellitus in 45.6% of the patients, glomerulonephritis in 28.2% and hypertension in 26.2%. The mean BMI was 29 (table 1).

580 (96.1%) patients had AVF. Of these: 320 (53.0%) were Saudis, 44 (7.3%) patients had AVG half of whom were Saudis, and 35 (5.8%) patients had cuffed central venous catheter: of whom 45.7 % were Saudis. The short-term patency (early AVF failure: less than 6 weeks) was 46.4% , the medium-term patency (6-52 weeks) was 17.8% and long-term patency (more than 52 weeks) was 38.8% (table 1).

The AVF patency rate was analyzed in relation to patients' gender, weight and nationality [table 2]. BMI had no impact on the short, medium or long-term survival of the AVF survival (p=0.49). Females were more likely than males and non Saudis than Saudis to have early AVF failure (p=0.0001 and p=0.0006 respectively).

We observed aneurismal formation in 15 (2.6%)

Table 3: AVF complications

Complication	No (%)
Early AVF Failure	268 (46.4%)
Aneurysmal formation	15 (2.6%)
Arterial steal syndrome	8 (1.4%)
Bleeding	4 (0.7%)
Venous Hypertension	3 (0.6%)
Nerve Injury	1 (0.2%)
Graft Reaction	1 (0.2%)

patients, arterial steal syndrome in 8 (1.4%), bleeding at the surgical site in 4 (0.7%), venous hypertension in 3 (0.6%), one patient had nerve injury and another one had a graft reaction (table 3).

Discussion

End Stage Renal Disease (ESRD) is quite prevalent worldwide. In the Kingdom of Saudi Arabia, a 10-15 fold increase in its prevalence was recorded since 1983 (1). The steady rise in the incidence and prevalence of ESRD is explained by the ever-increasing rates of diabetic nephropathy. The main mode of renal replacement therapy in Saudi Arabia is hemodialysis. In 2008, 8761 patients were undergoing hemodialysis at a cost of around \$ 224 (840 Million Saudi Riyals). This number is estimated to surpass 11,000 by the year 2010 (1, 2).

Vascular access for hemodialysis has its risks and can be expensive. Indeed, and despite recent technological and surgical advances, these procedures still carry considerable morbidity. Among the many complications encountered are: bleeding, infections, early AVF or graft failure, nerve injury, steal syndrome, venous stenosis, thrombosis and aneurysmal formation (3). There are three types of vascular accesses currently used: cuffed central venous catheters (CVC), arteriovenous fistula (AVF) and arteriovenous grafts. It has been documented that the majority of ESRD patients start their first hemodialysis session with a catheter (4). However, the use of CVC is associated with higher patient mortality

rate compared to the other two access types (5). AVF is less expensive, has superior patency rate and has fewer complications than venous catheters or artificial grafts (6). Therefore, agreed guidelines such as the National Kidney Foundation-Dialysis Outcomes Quality Initiative (NKF-DOQI) recommend the use of AVF (7).

More than 96 % of our patients ended up having AVF. These findings exceed the recommendations by the NKF-DOQI and the percentage of 67-91% reported by many western countries in recent years (8). The choice of type of vascular accesses is influenced by patient characteristics, morbidity and mortality posed by each procedure (9), and by the facility preferences (10).

Two hundred and sixty-eight (46.4%) of our patients had early AVF failure (less than six weeks). One hundred and three (17.8%) AVF were patent from six weeks to one year, and the remaining 207 (38.8%) AVF were functional for more than one year.

There is a wide distribution of 0.8% to 23.6% of early AVF failure reported by different series and centers (11). One possible explanation for the high rate of early failure in our series is the predominance of diabetes mellitus in our patients. Diabetics are known to have higher risk of primary AVF failure (12, 13). We observed that female gender is associated with more than 1.5 fold increase in early AVF failure ($P < 0.0001$). This is in accordance with similar observations reported in the literature (14). One proposed explanation for this observation is the smaller vascular diameter observed in females (15). In our series, most of our patients were either overweight or obese. However, BMI did not adversely affect AVF survival. This is in concordance with current recommendations of using AVF in obese patients (16). Finally, we found that non-Saudis have reduced AVF survival compared to Saudis. This could be attributed to the very late referral and sub-optimal follow-up for some of these patients who might be visitors to the Saudi Kingdom or are

on short stay visas.

As mentioned earlier, we think diabetes mellitus contributed to the high level of early AVF failure. We did not identify other causes of renal disease with similar effect.

In our study, the rate of other observed complications was relatively low varying from 0.2% to 2.6%.

Conclusion

In King Abdulaziz University Hospital (Jeddah, Saudi Arabia), and between 1993 and 2004, we were able to achieve a vast majority of AVF access for patients undergoing hemodialysis in accordance with the NKF-DOQI guidelines. However, there was a high early AVF failure especially in women and non-Saudis. Diabetes mellitus seems to be a strong contributing factor to early AVF failure. Further effort and research are needed to implement better approach for safeguarding AVF and finding possible other contributing factors for early AVF failure in patients afflicted with renal diseases in Saudi Arabia.

Conflict of interest:

None reported by all authors.

References

1. Shaheen FA, Al-Khader AA. Epidemiology and Causes of End Stage Renal Disease (ESRD). *Saudi J Kidney Dis Transpl.* 2005;16:277-81.
2. www.scot.org.sa. SCOT data [cited in 2009]
3. Derakhshanfar A, Gholyaf M, Niayesh A, Bahiraii S. Assessment of frequency of complications of arterio venous fistula in patients on dialysis: a two-year single center study from Iran. *Saudi J Kidney Dis Transpl.* 2009;20:872-5.
4. Lee T, Barker J, Allon M. Associations with predialysis vascular access management. *Am J Kidney Dis.* 2004;43:1008-13.
5. Astor BC, Eustace JA, Powe NR, Klag MJ, Fink NE,

- Coresh J, CHOICE Study. Type of vascular access and survival among incident hemodialysis patients: the Choices for Healthy Outcomes in Caring for ESRD (CHOICE) Study. *J Am Soc Nephrol.* 2005;16:1449-55.
6. Wasse H. Catheter-related mortality among ESRD patients. *Semin Dial.* 2008;21:547-9.
 7. Perera GB et al. Superiority of autogenous arteriovenous hemodialysis access: maintenance of function with fewer secondary interventions. *Ann Vasc Surg.* 2004;18:66-73.
 8. Ethier J, Mendelssohn DC, Elder SJ, et al. Vascular access use and outcomes: an international perspective from the Dialysis Outcomes and Practice Patterns Study. *Nephrol Dial Transplant.* 2008;23:3219-26.
 9. Di Iorio BR, Bellizzi V, Cillo N, et al. Vascular access for hemodialysis: the impact on morbidity and mortality. *J Nephrol.* 2004;17:19-25.
 10. Pisoni RL, Young EW, Dykstra DM, et al. Vascular access use in Europe and the United States: results from the DOPPS. *Kidney Int.* 2002;61:305-16.
 11. Ohira S, Kon T, Imura T. Evaluation of primary failure in native AV-fistulae (early fistula failure). *Hemodial Int.* 2006;10:173-9.
 12. Malovrh M. Native arteriovenous fistula: preoperative evaluation. *Am J Kidney Dis.* 2002;39:1218-25.
 13. Puskar D, Pasini J, Savić I, Bedalov G, Sonicki Z. Survival of primary arteriovenous fistula in 463 patients on chronic hemodialysis. *Croat Med J.* 2002;43:306-11.
 14. Vernaglione L, Mele G, Cristofano C, et al. Comorbid conditions and gender impact the primary survival of distal radio-cephalic arteriovenous fistula in patients on long-term hemodialysis. *J Nephrol.* 2005;18:276-81.
 15. Marcus RJ, Marcus DA, Sureshkumar KK, Hussain SM, McGill RL. Gender differences in vascular access in hemodialysis patients in the United States: developing strategies for improving access outcome. *Gen Med.* 2007;4:193-204.
 16. Chan MR, Young HN, Becker YT, Yevzlin AS. Obesity as a predictor of vascular access outcomes: analysis of the US-RDS DMMS Wave II study. *Semin Dial.* 2008;21:274-9.