Open Access

Original Article

Comparison of Patient Outcomes Before and After the Vascular Surgery Fellowship Program at Tertiary Care Hospital

Raoon Khan, Anum Arif, Ahsin Manzoor Bhatti, Mohammad Jamal Faisal, Maryam Iqbal

Combined Military Hospital, Medical College, Lahore/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective : To assess the outcomes in managing patients with chronic kidney disease (CKD) requiring vascular access before and after, a formal vascular surgery fellowship program (VSFP) was introduced in a tertiary care hospital in Punjab.

Study Design : Pilot quasi-experimental study.

Place and Duration of Study: Department of Vascular Surgery and Nephrology at Combined Military Hospital (CMH) ,Lahore Pakistan, from Feb to Oct 2020.

Methodology: Patients meeting the inclusion criteria of ages between 20 to 70 years, either gender and undergoing dialysis due to chronic renal failure were recruited in the study. Data was collected at the initial phase when a VSFP was absent and later when it was present. Outcome variables were current dialysis access, waiting time for permanent dialysis access and failure rate about the duration of chronic renal failure.

Results: A total of 226 patients were recruited in the study. In both pre-vascular surgery fellowship program time (pre-VSFPT) and post-vascular surgery fellowship program time (post-VSFPT), the predominant functional dialysis access at the time of the interview was arterio-venous fistula (AVF). However, they were much higher in the post-VSFPT, i.e., 46(54.1%) as compared to 96 (68.1%) (p= 0.069). In addition, in pre-VSFPT, 24 (28.2%) patients had a "Never Created" AVF status at the time of the interview as compared to 21(14.9%) in post-VSFPT, which was statistically significant.

Conclusion: The establishment of a fellowship program not only benefits the trainee but it improves patient care significantly. This study highlights the improvement in all the benchmarks of the formation of vascular access for hemodialysis after establishing a formal VSFP.

Keywords: Arteriovenous fistula, College of physicians and surgeons, Fellowship program, Vascular surgery.

How to Cite This Article: *Khan R, Arif A, Bhatti AM, Faisal MJ, Iqbal M. Comparison of Patient Outcomes before and After the Vascular Surgery Fellowship Program at Tertiary Care Hospital. Pak Armed Forces Med J 2023; 73(2): 518-522. DOI: https://doi.org/10.51253/pafmj.v73i2.8744*

INTRODUCTION

The first fellowship program for the training of peripheral vascular surgeons was established by Dr Jack Wylie at the University of California Medical Center, San Francisco, in 1962.[1,2] Since then, many such training programs have been established worldwide.[3] In Pakistan, a rise in the incidence of PAD has been observed due to the epidemic of vascular risk factors, including diabetes, obesity, smoking and sedentary lifestyles in the population.[4] However, specialist surgeons trained to treat such diseases are scarce because of minimal vascular surgery fellowship programs (VSFP) in the county. Currently, only 12 qualified vascular surgeons manage all private and government sectors.[5] Due to the fear of separation from mainstream general surgery training, introducing a formal VSFP has been slow in Pakistan and worldwide.[2,6]

Trained vascular surgeons are apt to perform various elective and emergency procedures, requiring extensive training for a thorough understanding of intricate complications.[7] In places where this speciality training does not exist, these procedures are carried out by cardiovascular surgeons, thoracic surgeons or general surgeons with some experience or added qualifications in vascular surgery. [6,8]

The addition of speciality training programs requires a hefty global investment. In Pakistan, the first VSFP was introduced in Agha Khan University Hospital, Karachi; In 2015, the College of Physicians and Surgeons Pakistan (CPSP) formally approved VSFPs nationally. Therefore, we conducted this study to assess the positive impact of our training program by evaluating the outcomes of patients with chronic kidney disease (CKD) requiring vascular surgical interventions before and after a VSFP was introduced in a tertiary care hospital.

METHODOLOGY

The pilot quasi-experimental study was conducted at the Department of Vascular Surgery and Nephrology, Combined Military Hospital (CMH) Lahore from February to October 2020 after approval

Correspondence: Dr Anum Arif, Department of Surgery, Combined Military Hospital, Medical College Lahore-Pakistan

Received: 18 May 2022; revision received: 23 Aug 2022; accepted: 24 Aug 2022

from the Institutional Review Board (IRB No. 285/2021).

Inclusion Criteria: Patients aged 20 to 70 years, either gender and undergoing dialysis due to chronic renal failure were recruited in the study.

Exclusion Criteria: Patients on dialysis due to acute kidney injury were excluded.

The initial phase includes the time before the induction of a formal VSFP when. Dataone consultant vascular surgeon did all surgeries were recorded in the Dialysis Center of our institute, including co-morbid, reason(s) for and duration of end-stage renal disease, frequency of hemodialysis per week, current hemodialysis access and its type, history of any previous arteriovenous fistula (AVF) in the past and if so, were there any complications. In the later phase, after nine months of induction of VSFP, similar data was again recorded in the Dialysis Center when both fellow and consultant vascular surgeons did angio-access surgical procedures. The initial phase is labelled pre-vascular surgery fellowship program time (pre–VSFPT), and the later phase is post-vascular surgery fellowship program time (post-VSFPT). Data was recorded by duty doctors at the Dialysis Center.

Data were analysed in Statistical Package for the Social Sciences version 21:00 (SPSS version 21). Quantitative variables were expressed as mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to find out the association. Independent sample t-test was applied to find the mean differences among the groups. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 226 patients were recruited in the study. The demographic variables are shown in Table-I. There was a male predominance in both pre-VSFPT and post-VSFPT. Patients' dialysis access characteristics are mentioned in Table-II, which shows that in pre-VSFPT and post-VSFPT, the predominant functional dialysis access at the interview was AVFs. However, they were much higher in post-VSFPT, i.e. 46(54.1%) as compared to 96(68.1%) (*p*=0.069). Furthermore, in pre-VSFPT, 24(28.2%) patients had a "Never Created" AVF status at the time of the interview as compared to 21(14.9%) in post-VSFPT, which was statistically significant. Another important finding in post-VSFPT was the greater number of immature fistulas, i.e., 23(16.3%) compared to 3(3.5%) in pre-VSFPT. This is visualised in the Figure and highlights the reduced waiting times for patients to receive an AVF post-VSFPT as more patients were seen awaiting maturation. During the post-VSFPT, there was a lower failure rate as 91(64.5%) were functional for dialysis compared to 53(62.4%) in pre-VSFPT.

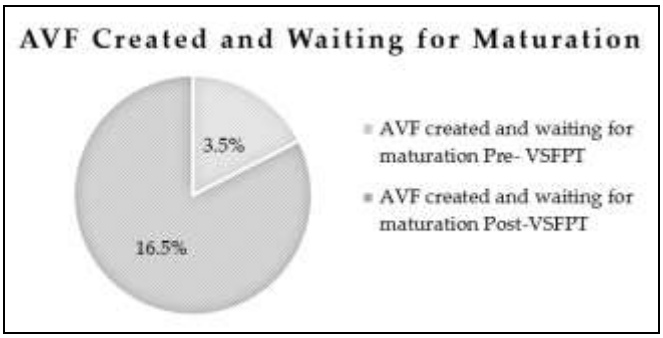

Figure: Patients with Immature Arteriovenous fistulas (AVFs) (n=26)

Table-I: Demographic Variables (n=226)

Variables	Pre-Vascular Surgery Fellowship Program time (pre–VSFPT)	Post-Vascular Surgery Fellowship Program time (post-VSFPT)	*p*-value
	n%	n%	
Gender			
Male	60(70.5)	93(65.9)	0.471
Female	25(29.4)	48(34)	
Age in Years			
<20	2(2.4)	1(0.71)	0.196
21-30	7(8.2)	9(6.38)	
31-40	4(4.7)	11(7.80)	
41-50	12(14.1)	15(10.6)	
51-60	33(38.9)	57(40.4)	
61-70	27(31.8)	37(26.2)	
71-80	0	10(7.09)	
>80	0	1(0.71)	
Reason for Dialysis			
Uncontrolled HTN	40(47)	67(47.5)	0.074
Uncontrolled DM	18(21)	38(27.0)	
BPH	1(1.2)	0	
Bilateral Renal Calculi	6(7.06	9(6.4)	
Nephritis	3(3.5)	7(5.0)	
PCKD	0	6(4.3)	
Congenital Abnormality	0	2(1.4)	
Reason Unknown	17(20)	12(8.5)	
Duration of Dialysis			
<1 year	53(62.3)	65(46.1)	0.059
1-5 years	27(31.8)	63(44.7)	
>5 years	5(5.9)	13(9.2)	
Frequency of Dialysis Visits/week			
1	4(4.7)	2(1.4)	0.101
2	62(72.9)	89(63.1)	
3	19(22.3)	49(34.8)	
4	0	1(0.7)	

Table-II: Dialysis access Characteristics in Pre-Vascular Surgery Fellowship Program Time (Pre-VSFPT) and Post-Vascular Surgery Fellowship Program Time (Post-VSFPT) (n= 226)

	Pre-Vascular Surgery Fellowship Program time (pre–VSFPT)	Post-Vascular Surgery Fellowship Program time (post-VSFPT)	*p*-value
Current Access Dialysis			
Line	39(45.9)	44(31.2)	0.069
AVF	46(54.1)	96(68.1)	
AVG	0	1(0.71)	
If Line, which of the following			
Subclavian Vein	17(43.6)	10(20.1)	0.060
Internal Jugular Vein	16(41.0)	30(61.2)	
Femoral Vein	6(15.4)	9(18.4)	
If AVF, which of the following			
Brachio-cephalic	24(51.1)	74(75.5)	0.002
Brachio-basilic	13(27.7)	6(6.1)	
Radio-cephalic	10(21.3)	17(17.3)	
AVG	0	1(1.0)	
Current AVF Status	24(28.2)	21(14.9)	0.006
Never Created Functional for Dialysis	53(62.4)	91(64.5)	
Previously Created AVF Cannot be used due to complications	5(5.9)	6(4.3)	
Previous AVF			
Yes	21(24.7)	29(20.7)	0.485
No	64(75.3)	111(79.2)	

DISCUSSION

The revolution of vascular surgery as an independent speciality has made a major impact in many healthcare institutions worldwide over the past few years.[3] We are pleased to add that our institution is one example; CMH Lahore is a tertiary care hospital that introduced its VSFP in 2020. As a standalone speciality, it is mostly sought out by male surgeons as it is thought to be a highly labour-intensive field. However, the first female vascular surgeon to be trained by CPSP was registered at our institution in 2020. Moreover, it is the only unit recognised for Fellowship of Vascular Surgery with the College of Physicians and Surgeons (FCPS) training in Central and Southern Punjab.

Today, there is an increase in demand for a generation of vascular surgeons who are versatile in performing extensive endovascular procedures.[3,4] One such procedure is the formation of dialysis access for patients with CKD. In the United States, vascular and transplant surgery is the main surgical specialities which provide training in dialysis access procedures. However, due to the regional scarcity of these departments, the more widespread cardiac and general surgeons often take on the task.[7] This is also the case in most regions of Pakistan. In other hospitals, interventional nephrologists are specialised in performing this procedure.[8] With the multiplicity of specialities gaining proficiency in endovascular procedures, the need for investing time and resources in providing a formal VSFP is often questioned. Our analysis positively impacted CKD patients requiring vascular access after introducing a VSFP. This discussion will highlight the necessity for expanding training programs in vascular surgery nationally and internationally.

According to a recent study, CKD is prevalent in 1 in 7 adults in South Asia, with an overall prevalence of 12% in Pakistan.[9] A mature, functional AVF access is the lifeline for a hemodialysis patient as it provides sufficient enough blood flow for adequate dialysis.10 We successfully identified 226 patients with CKD who underwent dialysis during our study period. During the pre-VSFPT of this study, 85 vascular access procedures took place, out of which 46 (54.1%) were AVFs done by one consultant vascular surgeon. This was compared to the post-VSFPT, when during the same period, 141 procedures took place, out of which 96(68.1%) were AVFs and 1 (0.71%) was an arteriovenous graft (AVG). A significant increase was observed in the number of patients who attended after a fellow vascular surgeon was added. In institutions like ours, where vascular access formation is primarily the role of vascular surgeons, the increased workforce is beneficial to allow the maximum number of patients to obtain this procedure to begin dialysis promptly and reduce the morbidity and mortality associated with this disease.[11]

The approach, diagnosis and management of vascular diseases are very different from approaches taken by the various other specialities, including the closely related cardiovascular surgeons.[6] Furthermore, surgical procedures - vascular or otherwise - are not a one-time job; In the case of CKD patients, they must be followed post-operatively for surveillance of arterio-venous access maturation and close observation for not only access and limb-threatening but also life-threatening complications, all of which require a noble understanding of AVF access salvage.[12] Thus, a separate program is essential for delineating patient ownership which can be described as "the philosophy that one knows everything about one's patients and does everything for them.[13]

When assessing the spectrum of surgical procedures, an inverse relationship can be observed between hospital volume and patient mortality.[14,15] This accentuates the idea that surgeons who perform a greater number of a given procedure develop a greater skill level; In simple terms, "Practice makes perfect.[16] Specifically, one of the major advantages of having a VSFP is that they have undoubtedly proven that the experience of vascular access during training has major implications for future practice, and surgeons who performed more AVFs during training had better patient outcomes when fully qualified.[14] Many studies have affirmed this, Saran *et al*. applied data from 12 countries in the Dialysis and Practice Patterns Study (DOPPS) to show that surgical training was a key factor in fistula placement and survival.[17]

Likewise, Goodkin *et al.* showed that vascular access surgery performed by surgeons who had placed a greater number of AVFs during their training was associated with a reduced risk of AVF failure.[18] This can be extended to other vascular procedures; A study done on abdominal aorta aneurysm (AAA) repair by Dimick et al. showed that increased specialisation in vascular surgery was associated with a significantly lower mortality rate, independent of AAA repair volume.[19]

In our study, there was a higher number of AVFs that were functional for dialysis during post-VSFPT, i.e., 91(64.5%) compared to pre-VSFPT, which had 53 (62.4%). Minimal fistula failures can thus be obtained with a full-fledged vascular surgery department with highly trained surgeons providing superlative services.

CONCLUSION

Only a few vascular surgical programs in Pakistan have adequate expertise and experience to function as endovascular teaching centres. The rapid evolution of training pro-grams is warranted for this speciality to prosper in treating peripheral vascular disease. Healthcare institutes and policy-makers must keep this fact in mind and strategies to expand the number of technically proficient and clinically adept vascular surgeons must be initiated. By expanding vascular surgery programs, a full range of interventional skills can be obtained for broad spectrum of percutaneous procedures.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

RM: Conception, interpretation of data, drafting the manuscript, approval of the final version to be published.

AA: Study design, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

AMB: Critical review, approval of the final version to be published.

MJF: Data acquisition, interpretation of data, approval of the final version to be published.

MI: Study design, Drafting the manuscript, interpretation of data, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

ACKNOWLEDGEMENT

Mr Ammad Asim, for his exceptional and continuous technical support.

REFERENCES

1. Van der Leeuw RM, Lombarts KM, Arah OA. A systemic review of the effects of residency training on patient outcomes. BMC Med 2012; 10: 65. doi:10.1186/1741-7015-10-65.
2. Perler BA, Zuidema GD. The effect of vascular fellowships on general surgical residency training. Ann Surg 1984; 200(3): 247-254. doi:10.1097/00000658-198409000-00002.
3. Al-Jundi W, Firdouse M, Morrow D, Wyatt M, Wheatcroft M. Vascular Surgery Fellowships: Comparison of Two Programmes in Canada and the UK. EJVES Short Rep 2018 ; 41: 28-31. doi: 10.1016/j.ejvssr.2018.10.006.
4. Rehman ZU, Sophie Z. Vascular surgery in Pakistan: critical issues. J Coll Physicians Surg Pak 2014 ; 24(6): 381-382.
5. Jamil M, Jamil B, Aman A. Challenges Faced by Vascular Surgeons in Acceptance of Their Speciality by Medical Community of Pakistan. Pak Armed Forces Med J 2021; 71(5): 1857-1860. doi:10.51253/pafmj.v71i5.4153
6. Singh D, Jawaid SA. Identity Crisis: Who is a Vascular Surgeon?. Pak J Med Sci 2006; 22(1): 3-5.
7. Sharp S, Gascue L, Goldman D, Lawrence PF, Romley J, Woo K. Higher Surgeon Procedure Volume Is Associated with Improved Hemodialysis Vascular Access Outcomes. Am Surg 2019; 85(10):1079-1082.
8. Ouriel K, Kent KC. The role of the vascular surgeon in endovascular procedures. J Vasc Surg 2001 33(4): 902-903. doi: 10.1067/mva.2001.113311.

9. Shrestha N, Gautam S, Mishra SR, Virani SS. Burden of chronic kidney disease in the general population and high-risk groups in South Asia: A systematic review and meta-analysis. PLoS One 2021; 16(10): e0258494. doi: 10.1371/journal.pone.0258494.
10. Shamasneh AO, Atieh AS, Gharaibeh KA, Hamadah A. Perceived barriers and attitudes toward arteriovenous fistula creation and use in hemodialysis patients in Palestine. Ren Fail 2020;42(1): 343-349. doi: 10.1080/0886022X.2020.1748650.
11. Bastos MG, Kirsztajn GM. Chronic kidney disease: importance of early diagnosis, immediate referral and structured interdisciplinary approach to improve outcomes in patients not yet on dialysis. J Bras Nefrol 2011; 33(1): 93-108.
12. Pirozzi N, Mancianti N, Scrivano J, Fazzari L, Pirozzi R, Tozzi M. Monitoring the Patient Following Radio-Cephalic Arteriovenous Fistula Creation: Current Perspectives. Vasc Health Risk Manag 2021 ; 17: 111-121. doi: 10.2147/VHRM.S205130.
13. Van Eaton EG, Horvath KD, Pellegrini CA. Professionalism and the Shift Mentality: How to Reconcile Patient Ownership With Limited Work Hours. Arch Surg 2005; 140(3): 230–235. doi:10.101 /archsurg.140.3.230.
14. Inston N, Singh TM. Training vascular access surgeons: technicians or specialists? Journal Vasc Access 2018; 19(2): 117-118. doi:10.5301/jva.5000824.
15. Roessler M, Walther F, Eberlein-Gonska M. Exploring relationships between in-hospital mortality and hospital case volume using random forest: results of a cohort study based on a nationwide sample of German hospitals. 2016–2018. BMC Health Serv Res 2022; 22:1. doi: 10.1186/s12913-021-07414-z.
16. Stulberg JJ, Huang R, Kreutzer L, Ban K, Champagne BJ. Association Between Surgeon Technical Skills and Patient Outcomes. JAMA Surg 2020; 155(10): 960-968. doi: 10.1001/jamasurg. 2020.3007. Erratum in: JAMA Surg 2020; 155(10): 1002.
17. Saran R, Elder SJ, Goodkin DA, Akiba T, Ethier J, Rayner HC, et al. Enhanced training in vascular access creation predicts arteriovenous fistula placement and patency in hemodialysis patients: results from the Dialysis Outcomes and Practice Patterns Study. Ann Surg 2008; 247(5): 885-891. doi: 10.1097/ SLA.0b013e31816c4044.
18. Goodkin DA, Pisoni RL, Locatelli F. Hemodialysis vascular access training and practices are key to improved access outcomes. Am J Kidney Dis 2010; 56(6): 1032-1042.
19. Dimick JB, Cowan JA Jr, Stanley JC, Henke PK, Pronovost PJ, Upchurch GR Jr. Surgeon specialty and provider volumes are related to outcome of intact abdominal aortic aneurysm repair in the United States. J Vasc Surg 2003; 38(4): 739-744. doi: 10.1016/ s0741-5214(03)00470-1.