

## ORIGINAL ARTICLE

# Early Complications of Arteriovenous Fistula in patients on maintenance Hemodialysis

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## ABSTRACT

**Background:** Repeated access to circulation is essential to conduct the adequate maintenance hemodialysis. The efficiency of arteriovenous fistula, being permanent source of access to vascular system in hemodialysis, is severely hampered by its complications

**Aim:** To determine the frequency of most common early complications of arteriovenous fistula in patients on maintenance hemodialysis.

**Methods:** This cross sectional study was conducted over a period of five years. Total 450 patients of hemodialysis were included. Informed consent was taken and demographics were noted. Early postoperative complications of AV fistula were recorded.

**Results:** Average age of the patients was  $39.61 \pm 8.17$  years. There were 255 (56.7%) males and 195 (43.3%) females. Radiocephalic fistula was constructed in 198 (44%) cases while brachiocephalic fistula in 252 (56%) cases. Among early complications, 19 (4.2%) cases had wound infection, 27 (6%) had thrombosed AV accesses and 12 (2.6%) had bleeding.

**Conclusion:** Early complications of AVF may compromise its efficacy as source of vascular access for maintenance hemodialysis. Timely detection and management improves patient morbidity.

**Keywords:** Maintenance Hemodialysis, Arteriovenous fistula, Infection, Thrombosis, Bleeding.

## INTRODUCTION

Chronic kidney disease (CKD) and end-stage renal disease (ESRD) are the global health problems worldwide. The prevalence of CKD varies by region, ranging from 7% to 24% worldwide.<sup>1</sup> In Pakistan, the prevalence of CKD is 16.6%–25%. Patients with CKD are commonly diagnosed at a late stage due to poor health education, scarcity of health facilities as well as late diagnosis of predisposing factor like hypertension and diabetes mellitus<sup>2,3</sup>. Patients presenting in advanced stages of CKD or ESRD can't be offered any treatment to reverse or slow down progression. These patients are the candidates of renal replacement therapy either dialysis or renal transplant.<sup>2</sup>

Hemodialysis is one of the ways of renal replacement therapy that requires repeated vascular access two to three times a week through AVF (AVF) created on one of the upper limbs.<sup>5</sup> It has become a necessary evil in the management of ESRD. Patient survival is up to 6 months if hemodialysis is not done in ESRD.<sup>2</sup> However it has its own side effects that limit its efficiency. Patients have the fear of needles. Repeated visits to hospitals affect the social and economic status of the patient.<sup>1,5</sup> These patients develop systemic as well as local complications including cardiovascular diseases, infections, and malignant

neoplasms and have a very poor prognosis as the mortality 3 years after the initiation of dialysis exceeds 30%.<sup>1,6</sup> Similarly local complications related to management of AVF are very cumbersome. Infection of AVF needs management by intravenous (IV) antibiotics, drainage of abscess and closure of fistula. Thrombosis of AVF leads to permanent loss of IV access. Similarly bleeding, ischemic steal syndrome and pseudoaneurysm of AVF may need secondary intervention and revision of fistula. Thus dysfunction of fistulas is the most common reason for recurrent hospitalization and increased morbidity.<sup>7,8</sup> These problems are more pronounced in resource poor countries due to their poor socioeconomic status.<sup>2</sup>

This study focuses on the knowledge of complications of AVF in our set up. In Pakistan, lack of a central registry makes epidemiological assessment extremely difficult and inadequate. Most of the data regarding disease burden estimates are mostly center-based.<sup>3</sup> So the aim of this study is to determine the frequency of most common complications of arteriovenous fistula in chronic renal failure patients on maintenance hemodialysis to get information regarding extent of problem in local setting and efficiency of AVF in patients of chronic renal failure.

The objective of the study was to determine the frequency of most common complications of arteriovenous fistula in patients on maintenance hemodialysis

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## MATERIALS AND METHODS

This cross sectional study was conducted from January 2014 to December 2029. Sample size was 450 using anticipated proportion = 7%, 95% confidence interval and 2.5% margin of error. Sampling technique used was non Probability (Consecutive) Sampling. Patients aged 15-65years, of both genders presenting with chronic renal failure with creatinine >2mg/dl and eGFR<30, undergoing hemodialysis for >6 months though atrioventricular fistula were included in the study. Patients with brachiocephalic fistula, in which fistula were constructed at the antecubital fossa or radiocephalic fistula, in which fistula were constructed at the wrist were included. Patients already diagnosed with cardiovascular disease or taking immunosuppressive medications, having malignancy, pro-coagulant conditions, or patients in whom graft material was used were excluded from the study.

**Data Collection:** The study was conducted after approval from hospitals research and ethical board. All patients fulfilled inclusion criteria were enrolled in the study through nephrology ward. A written informed consent was obtained from all patients. Medical history was taken from each patients including diabetes and hypertension and duration of hemodialysis. All patients underwent chronic hemodialysis for a mean time of 4.0hours three times a week. Blood flow rate ranged 250-300 mL/min, whereas a dialysate flow rate of 500 mL/min was used. Then patients were evaluated at fistula site and early complications within 4 to 6 weeks of AVF creation were noted. The complications were wound infection, thrombosed AV accesses and bleeding. All data were stored and analyzed in SPSS version 21.0.

## RESULTS

Average age of the patients was  $39.61 \pm 8.17$  years. There were 255 (56.7%) males and 195 (43.3%) females. There were 165 (36.7%) diabetics, 75 (16.7%) had hypertension while 210 (46.7%) patients had both diabetes and hypertension. Radiocephalic fistula was used in 198 (44%) cases while bronchiocephalic fistula in 252 (56%) cases. The mean maturation time of Radiocephalic fistula was  $42.42 \pm 4.45$  days while mean maturation time of bronchiocephalic fistula was  $38.23 \pm 4.54$  days ( $p < 0.05$ ) (Table 1). Among early complications, 19 (4.2%) cases had wound infection, 27 (6%) had thrombosed AV accesses and 12 (2.6%) had bleeding Table 2

Table 1: Demographics of patients (n=450)

Age	39.61±8.17
Gender (M:F)	255 (56.7%): 195 (43.3%)
<b>Comorbidities</b>	
Diabetes	165 (36.7%)
Hypertension	75 (16.7%)
Diabetes+ hypertension	210 (46.7%)
Radiocephalic fistula	198 (44%)
Bronchiocephalic fistula	252 (56%)

Table 2. Type of complications

Early complications	n
Total	58 (12.9%)
Wound infection	19 (4.2%)
Thrombosed AV accesses	27 (6%)
Bleeding	12 (2.6%)

## DISCUSSION

The ESRD is multifactorial with hypertension and diabetes being the major risk factors worldwide.<sup>1</sup> The prevalence of diabetes and hypertension varies among ESRD with hypertension being the leading cause in most of the studies.<sup>1,9,10</sup> In our study, diabetes was leading factor of CRF (36.7%) than hypertension (16.7%) which contradicts most of the international statistics and western data. However this is in agreement with a Pakistani study, in which common causes of renal failure identified were diabetic nephropathy (28%) and hypertension (14.6%).<sup>3</sup> another study by Demiral S et.al, DM was found in 43.2% patients and hypertension was found in 13.2% patients.<sup>7</sup> this difference is due to variable disease burden in different parts of the world with DM being the leading cause of ESRD in Indian subcontinent and Hypertension in the western countries.<sup>3</sup>

The preferred site of AVF is radiocephalic followed by brachiocephalic fistula,<sup>7</sup> however in patients with DM and peripheral vascular disease, brachiocephalic fistula is preferred to avoid complications related to vascular access and maintenance of fistula.<sup>7</sup> As most of the patients in our study were diabetic with deficiency of peripheral venous structures, brachiocephalic fistula was preferably constructed in majority of the patients (56%) to avoid its complications.

Thrombosis is among the common early and late complications in AV fistulas that may lead to loss of vascular access.<sup>8,9,11,12</sup> It occurs at the site of stenosis in AVF and may cause inflow and outflow obstruction.<sup>12</sup> In our study it was reported to be 6 %. In a study by Salahiet. al showing 2.2% patients were reported to have thrombosis<sup>12</sup>.

Infection accounts for majority of local as well as systemic AVF complications,<sup>13</sup> Most AVF infections involve perivascular cellulitis, which manifests as localized erythema and edema and is usually easily treated. Much more serious is an infection associated with anatomical abnormalities, such as aneurysms, hematomas or abscesses, which require surgical excision and drainage.<sup>13</sup> Infection rate in our study was 4.5%. Another study by Johny S et.al showed comparable infection rates of 3.4%.<sup>12</sup> Salahi et al reported relatively lower infection rates 0.5%<sup>11</sup> while Thabet 23.8% reported very high infection rate.<sup>6</sup>

Bleeding was another early complication and was found in 2.6% patients in our study. Similar rates of bleeding and hematoma formation were noted in study by Johny S et al. the rate of bleeding was low in Salahi et al 0.5%<sup>11</sup>.

Overall, variability in complication rates had been observed, partly due to poor quality studies, significant heterogeneity of study populations, and inconsistent definitions. There is an urgent need to standardize reporting of methods and definitions of vascular access complications in future clinical studies to better inform patient and provider decision making.<sup>11</sup>

## CONCLUSION

A functional AVF is a major determinant of successful HD; however, a complicated AVF may become a potential risk leading to morbidity and mortality of the patients on HD. Knowing the various complications of AVF helps the health care professional in their early detection and timely management, thus contributing significantly to reduce patient hospitalization, recurrent surgical interventions and loss of AVF.

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