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Quality of vascular access used for hemodialysis in Kirkuk hemodialysis unit

Abdulla Adil Raof [1]
Bilal Jamal Kamal [2]
Shan N. Nadhim [3]

(1) Kirkuk university, college of medicine,
Iraq
(2) Kirkuk university, college of medicine,
Iraq
(3) Pediatric hospital in Kirkuk,
Iraq

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ABSTRACT

BACKGROUND: Renal failure is increasing problem world wild and dialysis through vascular access is almost always done for the patients pending renal transplant, but a lot of complications can be caused by different types of the vascular accesses, this study assess the quality of vascular access in the dialysis unit in Kirkuk city.

OBJECTIVES: This study assesses the quality of different types of vascular accesses done for the renal failure patients, success rate and incidence of complications.

SUBJECTS AND METHODS: This is a community-based descriptive cross-sectional study done in Kirkuk city from the period of 1st January 2016 to the 31th December 2017 in the dialysis unit of Kirkuk general hospital in Kirkuk city, 154 patients complaining from renal failure are involved in this study, the age ranged from (16 – 72) years old.

RUSULTS: The study has showed that infection, thrombosis and arterial puncture were statistically significant complication associated with double lumen catheter especially in femoral vein.

Regarding the failure of AV fistula, there was no significant association between the site of AV fistula & its failure.

CONCLUSIONS: The study has showed that infection, thrombosis and arterial puncture were statistically significant complication associated with double lumen catheter especially in femoral vein. Diabetes has not been associated with increased risk of infection with double lumen catheter. Regarding the function of AV fistula there was no significant association between its success and the age of the patients also there was no significant association between the site of AV fistula & its failure

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*Corresponding author E mail : aikbek@yahoo.com

INTRODUCTION:

Chronic renal failure (CRF) refers to an irreversible deterioration in renal function as a result of falling in glomerullar filtration rate (GFR), and it is progressive and classically develops over years. At the beginning it manifests by abnormal biochemical results due to kidney inability to maintain normal low levels of the protein metabolism products (e.g. urea and creatinine), normal serum electrolytes level (e.g. Sodium, Potassium) and acid base balance. Finally if the patient is not managed properly clinical signs and symptoms of chronic renal failure will appear due to loss of the metabolic, secretary and endocrine function of the kidney.

Systemic diseases are common causes of chronic renal failure (CRF), especially hypertension (HT), diabetes (DM), amyloidosis, connective tissue diseases, like : systemic lupus erythematus (SLE), systemic sclerosis. Golemerulonephritis, renal stones, vascular disease and tubulointerstitial diseases are important non-systemic causes. Adult polycystic kidney disease (APKD) is a common hereditary disease that can cause chronic renal failure.

For patients with renal failure renal replacement therapy (RRT) is offered, which could be: (1) hemodialysis, (2) peritoneal dialysis, and (3) renal transplantation. Each of these three modalities of RRT is selected according to the clinical setting and patient preference.

An access to circulation is required to perform hemodialysis on regular repetitive basis, arteriovenous fistula (AVF) is the "gold standard" hemodialysis access, which means anastomosis of the radial artery to the cephalic vein, with subsequent "arterializations" of forearm superficial veins to enable blood flow rate up to 400 mL/min. This AVF takes 6 to 8 weeks to mature and hemodialysis can be done through it.

Percutaneous dual-lumen catheters provide immediate and convenient access to the circulation under local anesthesia. These catheters are indicated for patients in which hemodialysis is required urgently. These catheters can be inserted at internal jugular vein, subclavein vein or femoral vein.

Complication can occur during and after insertion of percutaneous dual-lumen catheters, peumothorax, pulmonary embolism, local thrombosis and infection, and septicemia.

This study shows the incidence of the complications of Percutaneous dual-lumen catheters inserted for patients complaining from chronic renal failure due to different causes and whether these complications are related significantly or not.

Subjects and Methods

This is a community-based descriptive cross-sectional study done in Kirkuk city from the period of 1st January 2016 to the 31th December 2017 in the dialysis unit of Kirkuk general hospital in Kirkuk city, 154 patients complaining from renal failure are involved in this study, the age ranged from (16 – 72) years old.

Detailed investigations are done for these patients to diagnose the underlying causes of renal failure,

including : biochemical tests, serological survey, complete blood count and blood film, abdominal ultrasound, glomerular filtration rate (GFR), general urine test.

Percutaneous dual-lumen catheter is inserted to these patients in to different sites, internal jugular, subclavian and femoral veins.

After placement of the percutaneous dual-lumen catheter the patients are followed up to detecting any complications that might occur, in situ hematoma, local infection or septicemia, cardiac arrhythmias (ECG is done), peumothorax (CXR is done in any patient in doubt).

AV fistula has done for these patients after placement of the percutaneous dual-lumen catheter, with careful follow up of these patients to see whether AV fistulas will success or fail to function.

Results

Table (1) shows sociodemographic characteristic of participants. Total number of patients is 154 patient ,the age ranged from 16 to 72 years (30 patient 19.4 %) are less than 30 years old, (84 patient 54.5 %) are between 30 – 60 years and (40 patient 25.9 %) are more than 60 years old . 100(64.63%) are male and 54 (35.06 %) are female. 107 (69.48%) living in urban and 47(30.5%) living in rural area .

Table (1) sociodemographic characterstic of paticipant

Variable		Number	Percentage
Age	< 30 Years	30	19.4 %
	30-60 Years	84	54.5 %
	60 Years>	40	25.9 %
Gender	Male	100	64.93 %
	Female	54	35.06 %
Residence	Urban	107	69.48 %
	Rural	47	30.5 %
Total number of patients		154	

Table (2) shows the underlying causes of renal failure in participant. The most common cause is hypertension (60 patient – 38.96 %). The second most common cause is diabetes mellitus (52 patients - 33.7%) , and renal stone is the third most

common cause (13 patients – 8.4 %) . other cause are as following , Glomerular disease (Glomerulonephritis and Nephrotic syndrome) (6 patients - 3.89%) , Interstitial nephritis (1 patient - 0.64%) , Autosomal dominant polycystic kidney disease (5 patients - 3.2%) , Nephrectomy (4 patients -- 2.59%) , others including unknown causes (13 patients - 8.4%). In about 32 patient (20.7%) there are more than one cause for renal failure (combined cause) .

Table (2) Underlying causes of renal failure in the participant

Etiology	Frequency	Percentage
Hypertension	60	38.96%
Diabetes mellitus	52	33.7%
Renal stone	13	8.4 %
Glomerular disease (GN.NS)	6	3.89%
Interstitial nephritis	1	0.64%
Autosomal dominant polycystic kidney disease	5	3.2%
Nephrectomy	4	2.59%
Others	13	8.4%
Combination 32	32	20.7%
T0TAL of patients	154	

Table (3) shows the duration of chronic kidney disease (time at which patient diagnosed as chronic kidney disease for a first time before dialysis) before start of dialysis . In 34 patient (22.07%) CKD diagnosed within only one month of starting dialysis .In 14 patient (9.09%) ,22 (14.2%), 7(4.5 %), 33(21.4 %) the duration of CKD is 2-3 month, 3- 6month , 6-9 month, 9-12 month respectively. Only 44(28.5 %) had duration of CKD before starting dialysis more than 1 year .

Table (3) Duration of chronic kidney disease before dialysis

Duration	<1 month	2-3 month	3-6 month	6-9 month	9-12 month	>1year	TOTAL
Frequency	34	14	22	7	33	44	154
Percentage	22.07%	9.09%	14.2%	4.5 %	21.4%	28.5%	100%

Table (4) shows 142 (92.2%) patient from a total of 154 had started dialysis by temporary double lumen catheter. Only 5 patients (3.2%) started dialysis by AV fistula. Seven patients (4.5%) started dialysis by peritoneal dialysis. There is no any patient using AV shunt in this study.

Table (4) Type of Vascular access (mode of dialysis) used at start of dialysis (first dialysis)

Vascular access	Double lumen catheter	AV fistula	AV shunt	Peritoneal dialysis	
Frequency	142	5	0	7	154
Percentage	92.2 %	3.2%	0 %	4.5%	100 %

Table (5) shows the duration of temporary double lumen catheter use from the start of dialysis. Thirty four patients (22.07%) from a total of 154 are using temporary double lumen catheter at the time of data collection. In 14 patient (41.1 %) were using temporary DLC (including femoral) for hemodialysis more than 3 month. others 6 patients (17.6%) for less than 1 month, 8 patient (23.5%) for 1-2 month , 6 patient (17.6%) for 2-3 month duration. No any patient had tunneled cuffed DLC.

Table (5) type of Vascular access used at the time of data collection and the duration of dialysis .

Duration	Duration of dialysis				
	< 1month	1-2month	2-3month	> 3month	
Frequency	6	8	6	14	34
Percentage	17.6 %	23.5 %	17.6 %	41.1 %	100%

Table (6) in around 50% of patients in the study undergo more than two temporary DLC . As the following frequency: 51 patients (33.11 %) had two times temporary DLC , 13 patients (8.4%) undergo temporary DLC 3 times , 5 patients (3.2 %) had more than 4 times temporary DLC , and 3 patients (1.9 %) undergo temporary DLC placement more than 4 times .

Table (6) Frequency of temporary DLC per patient

	Non	Once	Twice	Thrice	Four times	> 4 times	Total
Frequency	7	75	51	13	5	3	154
Percentage	4.5 %	48.7 %	33.11 %	8.4 %	3.2 %	1.9 %	100%

Table (7) demonstrate the commonly used first site for temporary DLC placement. In 68 patients (44.1%) the femoral vein was chosen as a first site for temporary DLC placement (the most common site), Internal jugular vein was the second most common site chosen (57 patients: 37%). Subclavian vein was chosen for 22 (14.2%) patients and peritoneal dialysis was done for 7 (4.5%) patients then changed to hemodialysis by AV fistula.

Table (7) Temporary DLC placement site chosen for first dialysis

DLC site	Femoral vein	Subclavian vein	Internal jugular vein	PD	Total
Frequency	68	22	57	7	154
Percentage	44.1 %	14.2 %	37.01 %	4.5 %	100%

Table (8) shows the complication seen with temporary DLC placement.

The complications had occurred in 58 patients (37 %) from a total of **154** patients. The femoral DLC site is most commonly associated with complications 37 from 68, subclavian vein complications were in 6 patients from 22, but complications in internal jugular vein were in 15 from 57 patients. (P value > 0.05)

Most common complication were infection occurred in 29 patient (50%) arterial puncture were the second most complication , thrombosis and hematoma were third most common complication occurred in 9 (15.5%) for both .

Table (8) Temporary double lumen catheter site

Complication	FEMORAL	INTERNAL JAGULAR	SUBCLAVIAN	Total
Infection	15	8	6	29
Thrombosis	9	0	0	9
Arterial puncture	7	4	0	11
Hematoma	6	3	0	9
Arrythmias	0	0	0	0
Air embolism	0	0	0	0
Pneumothrax	0	0	0	0
Total	37	15	6	58

Temporary double lumen catheter site and complications (p value > 0.05)

Table (9) shows 29 patient had DLC site infection and its correlation with diabetes mellitus. The most common site which is complicated by infection is femoral DLC (of the total 15 patients, 8 were diabetics), the second common site is the Internal jugular vein (of the total 8 patients, 5 were diabetics) but the least infected site is

subclavian site (of the total 6 patients,2 were diabetics). As it is shown there is no significant difference in infection incidence between diabetics and non diabetics (p value > 0.05).

Table (9) correlation of DLC infection with diabetes mellitus. (p value < 0.05)			
Infection	Diabetes mellitus		
	Yes	No	Total
Femoral	6 (54.5%)	5 (45.4%)	11
Internal jugular	7 (58.3%)	5 (41.6 %)	12
Subclavian	2 (33.3%)	4 (66.6 %)	6
Total	15 (51.7%)	14 (48.2%)	29

Table (10) shows the correlation between the DLC site infection and age, infection is most commonly occur at age group 30-60 years (48.2%).the second most common is the age group >60 years (27.5%) ,while least incidence is in the age group < 30 years, p value <0.05 .

Table (10) Infection site	Age				
Age	<30 years	30 -60 years	>60	Total	
Femoral	7(28%)	10 (40%)	8(32%)	25(48.07)	
Internal jugular	1(5.8%)	13(76.4 %)	3(17.6%)	17 (32.6 %)	
Subclavian	3(30%)	5(50%)	2(20%)	10 (19.2%)	
Total	11 (21.15%)	28(53.8%)	13(25%)	52 (100%)	

Table (11) shows the correlation of AV fistula function with age, at the time of data collection there was a total of 172 AV fistula done, 32 of them (18.6%) failed, failure rate is most common in age group 30-60 years (47.09%), in the age group of <30 , >60 years the failure rate is 20.9% & 31.9% respectively. There were no statistically significant association between the age and AV fistula failure (p value < 0.05)

Table (11) Correlation of AV fistula functioning with age				
	Age new			
AV fistula functioning	<30 years	30-60 years	>60 years	Total
Yes	31 (22.1%)	62 (44.2%)	47 (33.5%)	140
No	5 (15.6%)	19 (59.3%)	8 (25 %)	32
Total	36 (20.9%)	81 (47.09%)	55 (31.9%)	172

Table (12) shows the correlation between AV fistula failure and underlying disease causing renal failure. AV fistula failure most commonly occurred in patient with ESRD caused by hypertension, while the second most common AV fistula failure is associated with underlying diabetes mellitus. In ESRD due to renal stone failure has occurred in 13 of total 19 patients. In Glomrulonephritis failure has occurred in 7 of total 9 patients and in ADPKD failure was in 3 of total 4. Failure in nephrectomy patients were 3 in total 3.

Table (12) Correlation between underlying etiology & AV fistula failure, p value <0.05

	Etiology								
AV FAILURE	HT	DM	RENAL STONE	GN	IN	ADPKD	NEPHRECTOMY	OTHERS	TOTAL
No	61(43.5%)	28(20%)	13(9.2%)	7(5%)	0(0%)	3(2.1%)	3(2.1%)	25(17.8%)	(140)
Yes	11(34.3%)	9(28.1%)	3(9.35)	2(6.2%)	1(3.1%)	1(3.1%)	0 (0%)	5(15.6%)	(32)
Total No. of AV fistula	72(41.8%)	37(21.5%)	16(9.3%)	9(5.2%)	1(0.5%)	4(2.3%)	3(1.7%)	30(17.4%)	172

Table (13) in this table 14 patient (43.7) with AV fistula failure were patients with chronic kidney disease duration of 6-12 month (most commonly associated with AV fistula failure), followed by second most common AV fistula failure occurring with the duration of CKD more than 12 months (11 patients), those patient with duration of CKD of less than 6 months (7 patient – 21.8 %) are associated with least AV fistula failure rate (p value<0.05).

Table (13) Correlation of AV fistula failure with duration of CKD before dialysis, p value <0.05

AV failure	DURATION OF CKD before dialysis			
	<6month	6-12month	>12month	
No	54 (38.5%)	41 (29.2%)	45 (32.1%)	140
Yes	7 (21.8%)	14(43.7%)	11(34.3%)	32
Total	61 (35.4%)	55(31.9%)	56(32.5%)	172

Table (14) the percent of AV fistula failure according to the site of AV fistula is as follows ,the most common site is left wrist (12 patient 37.5%) ,second most common failure site is right wrist (9 patient 28.1 %) , left cubital fosse is the third most common failure site (7 patient 21.8 %) ,while right cubital fosse is the least common site for AV fistula failure (4 patient 12.5 %), statistically these finding is not significant (p value <0.05) .

Table (14) correlation of AV functioning with site of AV fistula p value <0.05					
		AV functioning			
Site		Yes	No	Total	
Right	Wrist	33 (23.5 %)	9 (28.1%	42	75
	Cubital fossa	29 (20.7%)	4 (12.5%)	33	
Left	Wrist	26 (18.5 %)	12 (37.5%)	38	97
	Cubital fossa	52 (37.1 %)	7 (21.8 %)	59	
Total		140 (81.3%)	32 (18.6%)	172	

Table (15) shows the frequency of AV fistula creation per patient.
In 118 patients (68.6%), AV fistula created once, in 25 patients (29.06%) the AV fistula created twice & for two patients (2.3%) AV fistula created trice.

Table (15)	Frequency of AV fistula	Total
once	118	118 (68.6%)
Twice	25	50 (29.06%)
Thrice	2	4 (2.3%)
Total		**172**

Discussion:

This is a cross-sectional study was carried out the dialysis unit of Kirkuk general hospital in Kirkuk city to evaluate the complications of vascular access for renal failure patients, in which double lumen catheter inserted for 154 patients at different sites (jugular, subclavian and femoral veins) and 172 patients arteriovenus fistula (AV fistula) was done for them.

The study has showed that infection, thrombosis and arterial puncture were statistically significant complication associated with double lumen catheter especially in femoral vein, this finding agrees with a study published by Qureshi et al, Douglas Squizatto et al, Kirkpatrik et al, Saad Al Shuhaib et al, & Hung Ky et al.

Diabetes has not been associated with increased risk of infection with double lumen catheter and this agrees with David P et al.

There was no significant association between the infection and age of patients with double lumen catheter. Regarding the function of AV fistula there was no significant association between its success and the age of the patients and this agrees with Beiuleu MC et al. Also there was no significant correlation between AV fistula failure and the underlying cause of renal failure and this agrees with Duque JC et al. The duration of chronic kidney disease before AV fistula wasn't associated with increased risk of failure. Regarding the failure of AV fistula, there was no significant association between the site of AV fistula & its failure.

Conclusion:

The study has showed that infection, thrombosis and arterial puncture were statistically significant complication associated with double lumen catheter especially in femoral vein. Diabetes has not been associated with increased risk of infection with double lumen catheter. Regarding the function of AV fistula there was no significant association between its success and the age of the patients also there was no significant association between the site of AV fistula & its failure

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