Original paper

Vascular Access Methods and Their Pattern of Evolution for Left Heart Catheterization at Two Tertiary Medical Centers in Nairobi: A Retrospective Chart Analysis

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Abstract

Background: Cardiac catheterization is an invasive procedure done by cardiologists (using specialized equipment) for diagnostic and /or interventional purposes for a wide range of cardiac diseases. Left heart catheterization entails insertion of a fine bore catheter via a peripheral vascular access into the aorta, coronary arteries and/or left heart chambers. The brachial, femoral, radial and/or ulnar arteries are used as peripheral arterial access routes. The increased utilization of trans-radial approach has led to lower rates of major bleeding and vascular complications. Trans-femoral arterial access approach is still used by many operators due to its ease of use and feasibility. Indications for cardiac catheterization majorly include evaluation and treatment of coronary artery disease, facilitate interventional procedures in valvulopathies, access congenital heart diseases prior to surgery and assessment of myocardial as well as pericardial diseases.

Objectives: To describe the vascular access methods for left heart catheterization and their associated complications at the Kenyatta National Hospital (KNH) and Karen Hospital (KR).

Methodology: A retrospective audit that examined health records of cardiac catheterization laboratories at KNH and KR over a 6-year period (1st January 2015 to 31st December 2020).

Results: A total of 384 files from the two hospitals: 106 from KNH and 278 from KR were analyzed. Files that were not well documented and files of patients that had had a right heart catheterization procedure were excluded. Of the total number of procedures done 62.1% were via the trans-femoral arterial access while 32.7% were via the trans-radial arterial access. Most of the procedures done at the KNH were via the trans-femoral access with the adoption of the trans-radial access noted from the year 2017 and steadily increasing till 2020. The use of trans-femoral in KR was also high but KR had a markedly increasing trend in adoption and incorporation of the use of the trans-radial arterial access over the entire study period. For patients with STEMI and NSTEMI, the use of the transfemoral access was still higher at 66.2% and 66.7% respectively. Looking at the acute peri-procedural complications (for example anaphylactic shock, cardiogenic shock, bleeding necessitating blood transfusion), it was noted that 39 (10.7%) patients experienced one or more of the complications, with about 19 (48.7%) of them having severe pain at puncture site. Twenty four (10.6%) had had a common femoral arterial access. On the length of hospital stay, most patients (50.3%) either stayed for a day or were discharged the same day followed by those that stayed between 2-5 days (32.1%).

Conclusion: Majority of the left heart catheterization procedures were done via the femoral access in Nairobi. The procedures done were safe with minimal complications. Over the study period, there has been a progressive shift to radial access in line with global trends.

Key words: Vascular access methods, Left heart procedure

Introduction

Coronary artery disease accounts for up to one third to one half of all cases of cardiovascular disease (1). The mainstay management of coronary artery disease is medical therapy and revascularization. Revascularization can be achieved via a coronary artery bypass graft or via a Percutaneous Coronary Intervention (PCI). Peripheral arteries like the femoral and radial provide access to the coronary arteries to perform diagnostic and/or therapeutic procedures (2).

Previous research has established the superiority of radial artery access in terms of bleeding and mortality thus creating a need for a paradigm shift in preference to the trans-radial arterial access approach. A study done by Hu Li *et al* (3) on trans-radial versus trans-femoral intervention in ST segment elevation myocardial infarction patients from January 2009 to

December 2009 at nine teaching hospitals revealed that trans-radial intervention in STEMI patients undergoing primary PCI with drug eluting stents was associated with a lower incidence of access site haematoma, twelve month repeat vascularization and major adverse cardiovascular events in comparison to the transfemoral intervention. To note is that the 2015 ESC guidelines for the management of ACS do recommend 'a radial first strategy' and has been described as a 'class 1 indication level of evidence A' for ACS management during cardiac catheterization. Vascular complications associated with these interventional procedures are not uncommon. Examples of complications include haematomas in groin which occur between 5% and 23% or retroperitoneal ranging from 0.15% to 0.44%, pseudoaneurysms ranging from 0.5% to 9% (4). Rarely, myocardial infarction, stroke, iatrogenic coronary dissection or pericardial effusion/tamponade, cardiac arrythmias and death may occur (5).

This study was designed to describe the vascular access methods for left heart catheterization at KNH and Karen Hospitals and assess the evolution of trends in the practice of vascular arterial access methods over the years. A comparison between complications associated with trans-femoral arterial access and trans-radial arterial access was also performed.

Materials and methods

This was a retrospective study. A review of files of patients who underwent left heart catheterization procedure at the KNH (the leading tertiary hospital in Kenya) and Karen Hospital (a private hospital) in Nairobi, Kenya between January 2015 and December 2020 was done. The charts were accessed from the cardiac catheterization laboratory registers in the two hospitals. The study evaluated the vascular access methods used in left heart catheterization over a 6-year period.

A study questionnaire with a unique ID for each patient was used to capture the data from the retrieved files after appropriate ethical approval. Data was then entered into Microsoft Excel. Data cleaning (entailing correcting for duplicates, missing data and inconsistencies), data coding and statistical analysis was done using SPSS (Version 23.0).

Demographic characteristics and clinical profiles of the patients were analysed and presented as frequencies and percentages. Complications were presented as percentages (over the total number of complications incurred). A chi-square test of homogeneity was used to determine differences in the demographic characteristics of the patients and the facilities, clinical examination profiles of the patients and the facilities, procedures done on the patients with the facilities, and vascular access methods with the facilities. Statistical significance was considered where the p-value < 0.05.

Results

A total of 121 files from KNH and 272 files from KR were retrieved for data collection. Fifteen files from KNH and 14 files from KR were excluded from the study as they either lacked a well documented inpatient number, incomplete doctor's notes documentation or had a right heart catheterization. Thus, a total of 106 files from KNH and 258 from KR were included in the study.

Demographic and clinical characteristics of study participants

The demographic characteristics of the patients show that most of the patients were in the age group 50-59 years (31.6%). On gender, male patients were 237 (65.1%) and female were 127 (34.9%). Majority of the patients were either self-employed (29.9%) or employed (35.4%). The clinical profile of the patients shows that 280 (76.9%) of the patients were hypertensive, 118 (32.4%) had diabetes mellitus, 43 (11.8%) had dyslipidemia, and only 3 (0.8%) had CHD. There were statistical differences between the two facilities for all the patient clinical examination profiles (Table 1).

The patients had one or more of the indications for procedure, of which the top three indications were stable Coronary Artery Disease (CAD/ IHD) 57.7%, acute coronary syndromes (24.5%) and cardiomyopathy (8.5%). A further detailed look at the acute coronary syndromes indicated that 19.5% of the ACS' were ST elevation myocardial infarction while 4.9% were non-ST elevation myocardial infarction. In terms of procedures, a coronary angiogram was the most common procedure done (79.1%), followed by coronary angiogram with PCI (20.4%).

Of note is that a majority of the vascular arterial access was via the common femoral artery (62.1%), followed by the radial artery (32.7%), and combined (5.2%). There were statistical differences between the two facilities for the arterial access methods with the use of the common femoral artery being higher in KNH and the use of the radial artery being higher in KR. For patients with STEMI, the use of the transfemoral access was at 66.2% while access via the trans radial route was at 25.4%; for the NSTEMI the use of the transfemoral access was at 66.7% while the use of the trans radial access was at 22.2%. There were no statistical differences between STEMI and NSTEMI for the methods of arterial access (Table 2).

Other indications for the procedures included 10 patients with a diagnosis of arrhythmias, 7 patients with LBBB, 5 patients each for syncope, and complains of severe dyspnoea, 3 patients with aortic stenosis undergoing an evaluation prior to repair, 3 patients

Table 1: Demographic characteristics of patients enrolled in the study

Characteristic	KNH, (n=106)	Karen, (n=258)	Total, (n=364)
Age group, *n (%)*			
<30	7 (6.6)	1 (0.4)	8 (2.2)
30 – 39	2 (1.9)	18 (7.0)	20 (5.5)
40 – 49	12 (11.3)	41 (15.9)	53 (14.6)
50 – 59	23 (21.7)	92 (35.7)	115 (31.6)
60 – 69	32 (30.2)	53 (20.5)	85 (23.4)
≥70	30 (28.3)	53 (20.5)	83 (22.8)
Gender**,** *n (%)*			
Male	59 (55.7)	178 (69)	237 (65.1)
Female	47 (44.3)	80 (31)	127 (34.9)
Occupation**,** *n(%)*			
Employed	11 (10.4)	118 (45.7)	129 (35.4)
Self-employed	32 (30.2)	77 (29.8)	109 (29.9)
Unemployed	34 (32.1)	19 (7.4)	53 (14.6)
Retired	7 (6.6)	30 (11.6)	37 (10.2)
Unknown	22 (20.8)	14 (5.4)	36 (9.9)

Clinical diagnosis of the patients' enrolled in the study

	KNH, *(n=106)*	Karen, *(n=258)*	Total, *(n=364)*	p-value
Hypertension, *n(%)*	94 (88.7)	186 (72.1)	280 (76.9)	0.001
Diabetes**,** *n (%)*	46 (43.4)	72 (27.9)	118 (32.4)	0.004
Dyslipidemia**,** *n (%)*	5 (4.7)	38 (14.7)	43 (11.8)	0.007
CHD**,** *n (%)*	3 (2.8)	0 (0)	3 (0.8)	0.024

Table 2: Indication for procedure of cardiac catheterization on the study patients

Indication	Frequency	Percent of patients *(n=364)*
Stable CAD/ IHD	210	57.7
ACS	89	24.5
Cardiomyopathy	31	8.5
Positive EST	18	4.9
Heart failure	5	1.4
Others	47	12.9

each for a pre-operative cardiac evaluation, and ASD, 2 patients each for evaluation post cardiac arrest, palpitations, ventricular tachycardia, and PAH, 1 patient each for AV canal defect, CCF in pregnancy, complete heart block, evaluation pre mitral valve repair, and Takayasu disease.

ACS by subtype in the study patients undergoing cardiac catheterization

ACS	Frequency	Percent of patients *(n=364)*
STEMI	71	19.5
NSTEMI	18	4.9

Procedure done

Procedure, *n (%)*	KNH, *(n=106)*	Karen, *(n=258)*	Total, *(n=364)*
Coronary angiogram	80 (75.5)	208 (80.6)	288 (79.1)
Coronary angiogram + PCI	25 (23.6)	49 (19.0)	74 (20.4)
Balloon mitral valvuloplasty	1 (0.99)	0 (0.0)	1 (0.3)

Vascular access method for cardiac catheterization at KNH and KR

Access	Common femoral artery	Radial artery	Combined	P-value
KNH, *(n=106)*	79 (74.5%)	26 (24.5%)	1 (0.9%)	0.002
Karen, *(n=258)*	147 (57.0%)	93 (36.0%)	18 (7.0%)	

Method of vascular access in ACS

ACS	Common femoral artery	Radial artery	Combined	Total	P-value
STEMI	47 (66.2%)	18 (25.4%)	6 (8.5%)	71	0.918
NSTEMI	12 (66.7%)	4 (22.2%)	2 (11.1%)	18	

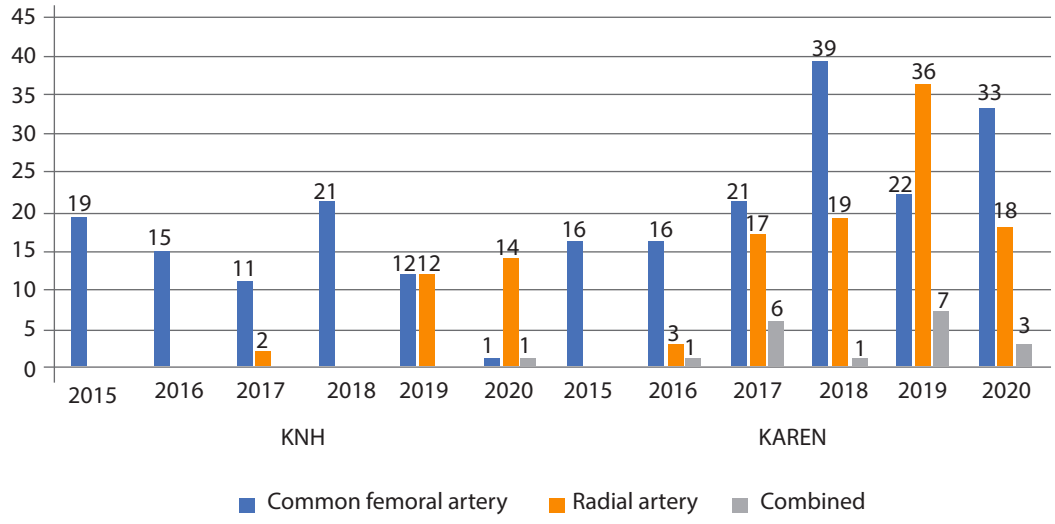
Evolution of choices of arterial access in the study population

The common femoral arterial access has been the method of vascular access for KNH as from 2015 to 2019 with a decline in 2020, while the same period saw the radial artery increasing. For Karen Hospital both the common femoral and radial artery was increasing on a yearly basis.

The trend for KNH shows that the common femoral artery was the mode used for vascular access from 2015 to 2018, and as from 2019 there was a balance of 50.0% each for common femoral artery and radial artery, while in 2020 the radial artery was the most used at 87.4%.

For Karen Hospital, of the 16 randomly selected files in 2015, all were common femoral artery. There was variability in the method of vascular access in the

Figure 1: Evolution of vascular access methods over the years for cardiac catheterization at KNH and KR

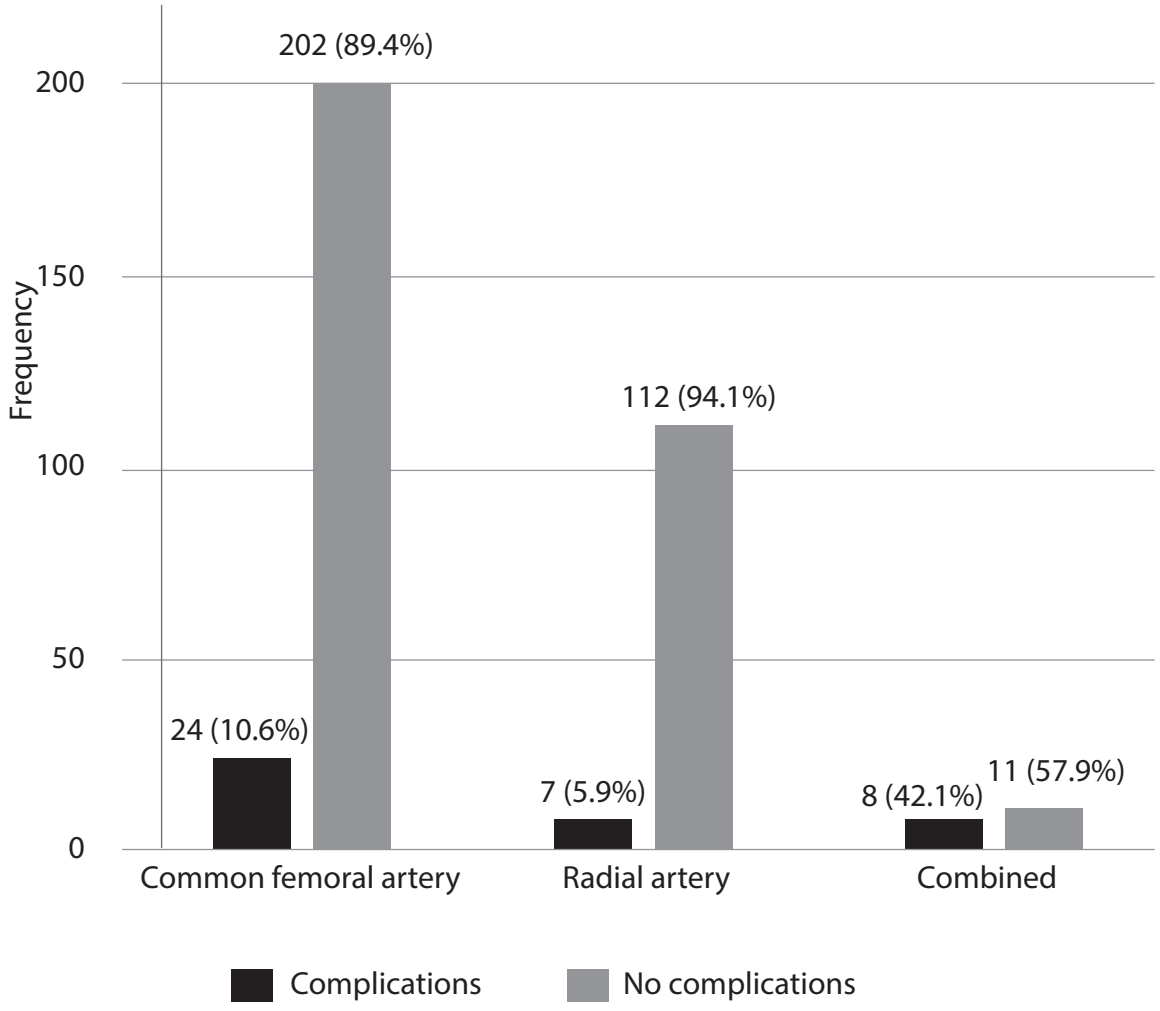


following years. In 2016 the most popular method of access was common femoral (80.0%), while in 2017 the common femoral and radial artery methods were used at 47.7% and 38.7% respectively. In 2018, the proportion of use of common femoral artery was double that of radial (66.1% vs. 32.2%), and this reduced in the following year, 2019, where the proportion of common femoral artery was almost half of the radial artery accesses (33.8% vs. 55.4%). In 2020, the proportion of the common femoral artery access was almost twice that of radial access (61.1% vs. 33.3%).

Complications and method of vascular access

There were 24 (10.6%) complications documented among the common femoral artery method of access while among the radial artery access method there were 7 (5.9%) documented complications, and lastly among the combined modes of access there were 8 (42.1%) cases of complications (Figure 2).

Figure 2: Complications and method of vascular access for cardiac catheterization in the study patients



There were 39 (10.7%) of the total patients who experienced one or more of the complications (Table 3), where of the 39 patients, 19 (48.7%) of them having severe pain as an associated complication and 7 (17.9%) having documented spasms. For this study, procedures done with cross overs from either a transfemoral or a transradial access were categorized as having had a combined arterial access.

The 39 patients that experienced one or more of the complications, 24 of them had the common femoral artery as their form of vascular access.

Table 3: Complications associated with each vascular access method in the study patients

Complication	Common femoral artery (n)	Radial artery (n)	Combined (n)	Proportion of patients (n=39) (n)
Severe pain	12	2	5	48.7%
Arterial spasm	3	2	2	17.9%
Haematoma formation	3	1	1	12.8%
Bleeding	3	1	0	10.3%
Hypotension	3	1	0	10.3%
Infection	3	1	0	10.3%
Acute kidney injury	3	0	0	7.7%
Ecchymosis	2	1	0	7.7%
Blood transfusion after procedure	0	0	2	5.1%
Cardiac arrythmias/Ventricular tachycardia	0	1	0	2.6%
Dyspnea	1	0	0	2.6%
Vomiting	1	0	0	2.6%
Cardiogenic shock	0	0	1	2.6%
Hypovolemic shock	0	0	1	2.6%
Arrythmia/Bradycardia	0	1	0	2.6%
Hemoptysis	1	0	0	2.6%

Complication and method of vascular access

There was no statistically significant difference (using the Pearson Chi-square test) in the proportions of patients who developed complications from the two methods of vascular access.

Incorporating the patients who had had a combined arterial access during the cardiac catheterization procedure, we noted that there was a statistically significant difference in the proportions for complications of the methods of vascular access, where the combined method had the highest proportion of complications, and not comparable with the proportions of the other two methods of vascular access. For this study, procedures done with cross overs from either a transfemoral or a transradial access were categorized as having had a combined arterial access (Table 4a and 4b).

Table 4a: Complications and method of vascular access

	Common femoral artery (n=226)	Radial artery (n=129)	P-value
Yes, *n (%)*	24 (10.6%)	7 (5.9%)	0.144

Table 4b: Complication and method of vascular access including the combined access

	Complications			
	Common femoral artery	Radial artery	Combined	P-value
Yes, *n (%)*	24 (10.6%)	7 (5.9%)	8 (42.1%)	<0.001
No, *n (%)*	202 (89.4%)	112 (94.1%)	11(57.9%)	

Length of hospital stay

Most patients in the study (50.3%) either stayed for a day or were discharged the same day followed by those who stayed between 2-5 days (32.1%). ANOVA (Analysis of variance) test was performed to determine if there were statistical differences for the length of stay (in days) in the three methods of vascular access. There were no statistical differences (Table 5a and 5b).

Table 5a: Length of hospital stay by vascular access

Length of stay (days)	Common femoral artery	Radial artery	Combined	Total, n (%)
0-1	106 (46.9%)	73 (61.3%)	4 (21.1%)	183 (50.3%)
2-5	79 (35.0%)	30 (25.2%)	8 (42.1%)	117 (32.1%)
6-10	26 (11.5%)	11 (9.2%)	6 (31.6%)	43 (11.8%)
>10	15 (6.6%)	5 (4.2%)	1 (5.3%)	21 (5.8%)
Total	226	119	19	364

Table 5b: Analysis of variance for the length of stay in the three methods of vascular access

	Sum of squares	df	Mean square	F	P-value
Between groups	80.1	2	40.0	2.32	0.100
Within group	6230.7	361	17.3		
Total	6310.8				

Discussion

This study documented the vascular access methods used for left heart catheterization at the KNH and Karen Hospitals. The study also looked at the adoption of the trans radial access method due to the fact that the 2015 ESC guidelines for the management of ACS that actually recommend 'a radial first strategy' and has been described as a 'class 1 indication level of evidence A' for ACS management during cardiac catheterization.

In this study, the age range of most patients undergoing the procedure was 50-59 years, males constituting a majority at 65.1%. Contrast to our study, most of the western world data (high income countries) indicate increased ages (6,7) for patients undergoing cardiac catheterization. A retrospective study done by Ambassa *et al* (8) to analyse the results of heart catheterization in the cardiac centre Shisong, Kumbo in Cameroon from December 2010 till December 2017 it was also noted that the mean age of patients undergoing the procedure was 52.6 ± 12.9 years with a majority being the male gender (8,9). A retrospective study (1996-2001 done by Kamotho *et al* (7) in Kenya at the Nairobi Hospital on coronary angiography also found majority of the patients had a mean age of 54.4 years with a predominantly male population. This can be attributed to the fact that most male patients have more cardiovascular risk factors including smoking than their female counterparts.

In this study most of the patients undergoing cardiac catheterization procedures had hypertension at 76.9% followed by diabetes mellitus at 32.4%. Studies done on heart catheterization also indicate most of the patients undergoing this procedure have established risk factors for cardiovascular disease with most being hypertensive (7,10). Hypertension has been noted to be a leading risk factor for coronary artery disease, more so when involved with an end organ target (7,9). Prevalence of hypertension is also high among our Kenyan population (7) and this could explain why most of the patients in the study were found to have hypertension.

The commonest indication for the procedure was coronary artery disease at 57.7%, acute coronary syndromes (24.5%) and cardiomyopathy (8.5%). Coronary angiography was the commonest procedure done for 79.1% of the study patients while coronary angiography with PCI was at 20.4%.

A majority of the procedures were done via the transfemoral route (62.1%) while transradial use was at 32.7%. For this study, procedures done with cross overs from either a transfemoral or a transradial access were categorized as having had a combined arterial access; for 5.2% of the study patients. While we appreciated the progressive adoption of the trans radial approach (though slow), our use of the trans radial access was lower in comparison to the global data. It is now well agreed globally that the radial first

strategy is standard practice (11) due to reduced post procedural related complications.

A retrospective study done by Tewari *et al* (12) from 2004-2011 at North Indian Cardiology Centre in India found the use of trans radial arterial access to be at 44.35% while a systematic review and meta-analysis study done by Di Santo *et al* (13) looking at 14 randomized control studies published at inception till January 2020 in the MEDLINE, Cochrane Central Register of controlled trials found that up to 49.6% of patients had their PCI done via the trans radial approach. The trans radial has become a default arterial approach site for PCI in Europe, Asia and the USA (11).

Contrast to our study where the use of the transfemoral access was at 62.1%, a study done in the USA in 2016 by Damluji *et al* (14) on transfemoral approach for coronary angiography and intervention (using a study survey tool administered to operators) with an aim to examine the current practice and use of transfemoral artery approach found that, of the 987 operators, only 18% identified themselves solely as femoralists, 38% as radialists while 42% as both (14). Another nationwide study by Changal *et al* (11) in the USA in 2020 to assess the current training preference, expertise, and comfort with transfemoral and trans radial among cardiovascular training fellows found that up to 95% of trainees chose trans radial as their default arterial access and the reasons cited by the trainees included patient satisfaction, low complications and the training centres 'radial first' policy.

Contrast to our study where we found more of transfemoral access procedures, we theorized this could be related to level of operators training and comfort in use of the trans radial method. In our study again we noted that a number of cross overs were from trans radial to transfemoral access and documented reasons were severe pains at site of puncture inducing spasms and then hindering catheter advancement or simply difficulty in engaging the coronaries and this warranted a change over to the transfemoral access which was then successful.

Similarly, it has been noted that transfemoral access method is still a preferred method for cardiac catheterization even with the increasing incorporation of the trans radial access and this could be attributed to the user preference (10,15) and experience or need for use of large bore catheters during the procedure. Transfemoral access still remains the preferred method of access choice during cross over procedures (16) when complete total occlusions of vessels are noted during the interventional procedures. To note is that the distribution of participants who underwent transfemoral access and trans radial arterial access procedures differed significantly between KNH and Karen Hospital; the use of transfemoral access was higher at KNH while the use of trans-radial access was higher at KR. Thus, this study theorized that the increased adoption of trans radial access by private hospitals may be in an attempt to comply with the radial-first strategy as per the ESC cardiac catheterizations guidelines (17) and with the rest of the world at large. Similarly, a study done on evolution of arterial access for cardiac catheterization by Ziakis *et al* (18) to reveal volumes and trends in interventions performed on trans radial access in Northern Greece in the selected years of 2004, 2009 and 2013 indicated that it was at 0% in 2004 to approximately 40% in 2013; the adoption being higher in private hospitals as compared to the public hospitals' cardiac catheterization laboratories.

In terms of the arterial access use and evolution over time, the uptake in use of the trans radial access has demonstrated a slow but progressive uptake in both KNH and KR Hospitals, the uptake noted to be higher in KR. Data from several studies indicate a rise in the use of the trans radial arterial access over time. A study done by Santo *et al* (19) found a rise in the use of trans radial access from 0.2% to 37.2% over their study period time. Similarly, in our study we noted an increase in use of trans radial arterial access over our 6-year study duration. In our study, very few patients experienced post procedural related complications.

There were 39 (10.7%) of the total patients who experienced one or more of the complications where of the 39 patients that experienced one or more of the complications, 24 of them had the common femoral artery as their form of vascular access. This proves the generally known fact that cardiac catheterization is a safe and sterile procedure (20). Severe pain at puncture site were the commonest complications noted to the point that stronger analgesics including morphine, pethidine or tramadol had to be given to these patients and a re-assessment of the puncture site done. Bleeding and haematoma formation at puncture site occurred in three of the patients who had had a transfemoral access and this necessitated change of dressing in order to apply adequate pressure and stop the bleeding.

Some patients developed hypotension post-procedural and had to be transferred to the high dependency unit for intravenous fluids and dobutamine administration. Three patients developed infection within two to three days after the procedure and this was documented as hotness of body and chills and intravenous antibiotics were prescribed. A patient developed chills and vomiting during the procedure that resolved after administration of intravenous hydrocortisone and this was attributed to be an allergic reaction to administered contrast during the procure. A prospective study done by Baskaran *et al* (21) on complications of cardiac catheterization at the Montreal Heart institute in Canada between April

1996 and March 1998 found complications occurred in 8% of cardiac catheterization procedures done, with local complications accounting for 2.5%. In their study, deaths occurred in 0.6% of the study participants.

Studies done also indicate that majority of the complications are noted among patients who have had a common femoral arterial access (20). Deaths related to complications were not documented in our study population again confirming that this is a rare complication comparable to previous studies done (22,24).

Most of the patients were discharged on the same day or had a one-day hospital stay. Again, conforming to the standard practice that cardiac catheterization is a safe procedure (25,26). We noted that some of the patients who had more than a day hospital stay had other underlying comorbidities including chronic kidney disease and thus needed continuity of care after the procedure. Two patients with stable chronic kidney disease needed haemodialysis after the procedure due to an acute kidney injury, while two patients with normal kidney functions prior to the procedure developed acute kidney injury after the procedure and this automatically equated to prolonged hospital stay for stabilization. Three patients needed blood transfusion after the procedure as they were noted to have low haemoglobin levels after the bleeding complications and there was a delay in sourcing for blood for them with one of the patients staying in the ward for up to 10 days waiting for a blood transfusion. We also noted that some patients had come from far away counties and three other patients had come from neighbouring countries and as such could not travel back to their referring facility/ home till travel arrangements were made in the following days. Three patients had to stay longer and wait for a recommended CABG procedure.

Patients who had a crossover from a trans radial access to a transfemoral access or from a transfemoral to a trans radial access during the procedure were categorized as having had a combined arterial access. This group of patients constituted a 5.2%. A two-year prospective study done by Aldoori *et al* (27) on trans radial approach for coronary angiography and PCI in the Slemani Cardiac Hospital in Iraq (2015-2016) also found a cross over from a trans radial to a transfemoral arterial access to be at 4.4%. We hypothesized that the crossover to transfemoral approach could be attributed to tortuosity of the aorta and brachiocephalic trunk, radial artery spasm, puncture failure or due to a radial loop. Patients who had a combined arterial access were noted to have more complications as compared to the others that had only had a one arterial access use. This we hypothesized that it could be due to the fact that patients having a crossover have a prolonged exposure to the radiocontrast material during the procedure or there's exchange of more catheters during the procedure hence theoretically having more related complications. Of note is that in our study, we did not retrieve a single file with a trans ulnar arterial access which is still a new arterial access in practice. We theorize that it will be another upcoming method to be considered for cardiac catheterization in the future as it has been shown to be safe and a potential alternative to the trans radial approach (28,29).

Conclusions

Cardiac catheterization is in use for both diagnostic and interventional purposes. Of the procedures done 79.1% were coronary angiograms while 20.4% were coronary angiograms with PCI. The vascular access routes in use for KNH and KR included the trans radial and transfemoral routes, and as from 2016, there has been a progressive adoption and incorporation of the trans-radial arterial access in practice. The complications profile was low. Finally, most of the patients were discharged within the same day of the procedure or within a day.

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