ORIGINAL ARTICLE

Role of Doppler Ultrasound in Comparison With MDCT Angiography in the Assessment of Lower Limb Peripheral Arterial Disease

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ABSTRACT

Aim: Role of Doppler ultrasound in comparison with MDCT angiography in the assessment of lower limb Peripheral arterial disease.

Methodology: This study was conducted in Radiology department of Shalamar Hospital Lahore. A total of 42 patients (31 males and 11 females) diagnosed with PAD by using both Doppler ultrasound and MDCTA were included. The data collected was entered, tabulated and statistically analyzed on IBM-SPSS 25.0 version.

Results: A total of 336 arterial segments were assessed on both modalities. Duplex ultrasound detected 278 (83%) positive patent segments, 124(37%) segments showing atherosclerosis and 63(19%) segments with stenosis/thrombus, in comparison to MDCTA which was able to detect 221 (66%) patent vessels,153(46%) segments showing atherosclerosis and 114 (34%) segments showing thrombus/ stenosis. The results showed that the MDCTA was able to detect 15% more arterial segments with stenosis/ thrombus and 9% more segments with atherosclerotic plaques as compared to Doppler.

Conclusion: Doppler ultrasound is the modality of choice in detecting grade 0 and 1 PAD while. MDCTA is more accurate in assessing patients with grade 2 and 3 PAD who need surgical intervention.

Key Words: PAD, Duplex ultrasound, Multidetector CT Angiography

INTRODUCTION

Peripheral arterial disease (PAD) is a partial or complete failure of the arterial system to deliver oxygenated blood to peripheral tissues and progresses with age and decreases the life expectancy of patient[1,2].

Other causes include arterial entrapment, thrombus, adventitial cyst, embolism, fibro muscular dysplasia, dissection, trauma, vasculitis, vasospasm[3]. PAD is mostly caused by atherosclerosis of arteries distal to the aortic bifurcation and most commonly occurs in lower limb[4].

The objective of the study was to assess role of Doppler ultrasound in comparison with MDCT angiography of lower limb Peripheral arterial disease.

METHODOLOGY

This retrospective study was conducted in Radiology Department, Shalamar Hospital, Lahore after permission from IRB for a period of 12 months i.e. 01-01- 2020 to 31- 12-2020 in which 42 cases were included. Sampling Technique used was **c**onvenient sampling technique.

Study Population: PAD patients attended OPD and admitted in IPD of Shalamar Hospital Lahore and fulfilling the inclusion criteria.

Inclusion Criteria: Patients of both genders with age group 30-85 years, patients presented with clinically diagnosed lower limb PAD and patients who had performed both doppler USG and MDCT angiography.

Exclusion Criteria: Patients with repeated scans, previous amputation surgery and had only performed either doppler USG or MDCT.

Data collection procedure: After the approval from the SMDC-IRB and getting permission from Shalamar Hospital, the data from hospital record was taken. All patients confirmed with PAD on basis of previous history, clinical examination and radiological finding of duplex USG and multidetector CT were included. The data was analyzed on SPSS 25 version. Approval of the institutional ethics committee was obtained.

RESULTS

Table 1: Risk factors of PAD (n=42)

Risk Factors	n	% age
Hypertension	25	71
Diabetes	30	86
Cardiac problem	5	14
Smoking	20	57
Previous surgery	4	11
Hyperlipidemia	22	63

Table 2: MDCTA and Doppler USG in detecting patent vessels

Arterial segment	MDCT		Doppler USG		P value
	Yes	No	Yes	No	
CIA	28	14	34	8	0.00***
CFA	28	14	31	11	0.00***
SFA	25	17	30	12	0.00***
DFA	33	9	38	4	0.00***
PA	23	19	34	8	0.008**
ATA	28	14	35	7	0.00***
PTA	25	17	37	5	0.055*
DPA	31	11	39	3	0.10

CIA= Common Illiac Artery, CFA=Common Femoral Artery,
SFA= Superior Femoral Artery, DFA= Deep Femoral Artery,
PA= Popliteal Artery, ATA= Anterior Tibial Artery,
PTA= Posterior Tibial Artery, DPA=Dorsalis Pedis Artery
*$p<.05$. **$p<.01$. ***$p<.001$

Table 3: MDCTA and Doppler USG in detecting vascular calcification/ atherosclerosis

Arterial segment	MDCT		Doppler USG		P value
	Yes	No	Yes	No	
CIA	26	16	23	19	0.00***
CFA	23	19	21	21	0.00***
SFA	16	26	19	23	0.00***
DFA	16	26	12	30	0.00***
PA	16	26	12	30	0.00***
ATA	18	24	13	29	0.00***
PTA	20	22	12	30	0.00***
DPA	18	24	12	30	0.00***

*$p<0.05$ **$p<0.01$ ***$p<0.001$

Table 4: MDCTA and Doppler USG in detecting arterial stenosis/ thrombus

Arterial segment	MDCT		Doppler USG		P value
	Yes	No	Yes	No	
CIA	12	30	10	32	0.00***
CFA	15	27	12	30	0.00***
SFA	17	25	12	30	0.00***
DFA	9	33	6	36	0.00***
PA	18	24	7	35	0.001***
ATA	14	28	6	36	0.00***
PTA	17	25	8	34	0.003**
DPA	12	30	2	40	0.022*

*p<0.05 **p<0.01 ***p<0.001

Table 5: Doppler ultrasound and MDCTA

Modality	Patent	Vascular Atherosclerosis	Thrombus/ Stenosis
MDCTA	221	153	114
Doppler USG	278	124	63

DISCUSSION

In our study, Diabetes mellitus was the major risk factor leading to PAD. Out of 42 patients, 30 patients (86%) were presented with diabetes mellitus that was in accordance with the finding of the study by Kumar R et al [5] while other risk factors noted in our study are hypertension (71%), hyperlipidemia (63%), smoking (57%), cardiac problem (14%) and previous surgery (11%). According to the Kondeti K et al[6] smoking was a major risk factor in the development of PAD.

In our study, a total of 8 bilateral lower limb arterial segments (336 segments) of 42 patients were evaluated in the study, which included CIA (2 segments), CFA (2 segments), SFA (2 segments), DFA (2 segments), PA (2 segments), ATA (2 segments), PTA (2 segments) and DPA (2 segments). There was no significant difference between the right and left arterial segments in disease distribution.

In our study, out of 336 arterial segments, MDCT Angiography was able to detect 221 (66%) positive segments which are patent in comparison to doppler USG which detected 278 (83%) positive segments. .MDCT was able to detect 22% diseased segments while doppler detected 13% diseased segments. So, the results showed that the MDCT was able to detect 9% more diseased segments as compared to doppler USG. Similar finding were noted by Kumar R et al[5], in which MDCTA showed 11.2% more diseased segments as compared to Doppler.

In this study, out of 336 arterial segments, MDCT was able to detect 153 (46%) positive arterial segments showing vascular calcification in comparison to doppler USG which showed 124(37%) arterial segments. So MDCT detected 9% more segments with vascular calcifications or atherosclerotic plaques as compared to doppler USG. Our results were comparable with Kondeti K et al[6], which noted that the MDCT detect 4% more arterial segments showing vascular calcification as compared to doppler USG.

In our study, results showed that MDCTA was able to detect 114 (34%) segments having thrombus/ stenosis while doppler was able to detect 63(19%) segment with stenosis/thrombus. The results of our study concluded that the MDCTA was able to detect 15% more arterial segments with stenosis/ thrombus as compared to doppler USG. Results of our study are in accordance with Kondeti K et al[6] who showed that MDCTA was able to detect 43.5% positive segments with stenosis as compared to doppler USG i.e. 32.4% positive segments. MDCT detected 11.1% more positive cases.

CONCLUSION

Both Duplex USG and MDCTA have statistically significant results in assessing patients with grade 0 and 1 PAD who need medical therapy but Doppler USG is the modality of choice because it is non-invasive, radiation free imaging modality. MDCTA is more accurate in assessing patients with grade 2 and 3 PAD patients who need surgical intervention.

Conflict of interest: Nil

REFERENCES

1. Gardner, A.W. Prevention, Management of lower extremity peripheral arterial disease. 2008. 28(6): p. 349.
2. El Dein, A.I.G., et al., Comparative study between duplex ultrasound and 160-multidetectors CTA in assessment of chronic lower limb ischemia. 2019. 50(1): 1-8.
3. Ali, Z.A., Habib, A. Comparative study between Doppler ultrasound and CTA in diabetic lower limb arterial insufficiency 2018. 31(3): 1050.
4. Hardman, R.L. Overview of classification systems in peripheral artery disease. in Seminars in interventional radiology. Thieme Medical Publishers. 2014.
5. Kumar, R. and Taneja A. Role of multidetector CTA in evaluation of peripheral arterial disease. Int. J of Research in Medical Sciences. 2020: 8(7): 7
6. Kondeti, K. Role of color Doppler ultrasound and MDCT angiography in the evaluation of peripheral arterial disease. 2020. 9(2):. 86-91.