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Reference Diameters of the Abdominal Aorta and Common Iliac Arteries in Ethiopian Adults on Abdominal CT: A facility-based cross-sectional study

Thesis Submitted to the Department of Clinical Radiology of Addis Ababa University in Partial Fulfilment of the Requirements for the Specialization Degree in Clinical Radiology

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Abstract

Background: Aortic and common iliac artery diameters are best indicators for diagnosis of aortic ectasia and aneurysm, and appropriate selection of stent graft size for endovascular procedures. Currently, there is lack of evidence regarding abdominal aorta and common iliac artery diameter in Ethiopian adults.

Objective: To assess mean diameter and associated factors of abdominal aorta and common iliac artery diameters on abdominal CT scans of Ethiopian adults visiting Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Methods: Hospital-based cross-sectional study was conducted. Convenience nonprobability sampling method was employed. Data were collected from consecutive eligible adults who came for abdominal CT scans in study period, using interviewer-administered structured questionnaires. The data was cleaned and analysed using SPSS version 22. Student t-test and Pearson correlation were used for statistical analysis.

Results: There were 136 study participants and 50 (40.4%) of participants were males and 81(59.6%) were females. Age of participants ranged from 23 up to 77 with mean age of 48.5 ± 13 years. The mean transverse diameter of the aorta at aortic hiatus (T12) level was 2.30 ± 0.25cm in males and 2.03 ± 0.19 m in females. The mean transverse diameter of suprarenal aorta was 2.04 ± 0.21cm in males and 1.83 ± 0.21 cm in females. Those individuals of male sex, increased age, larger BSA, and alcohol consumption were having larger diameters.

Conclusion: In this study, Diameter of aorta and common iliac artery was significantly associated with age, sex, BSA, and alcohol consumption.

Keywords: Abdominal aorta, Common Iliac Arteries, Ethiopia

Acronyms /Abbreviations

AA	Abdominal Aorta
AAA	Abdominal Aortic Aneurysm
BMI	Body Mass Index
BSA	Body Surface Area

CT	Computed Tomography
RAAS	Renin–Angiotensin–Aldosterone System
SMA	Superior Mesenteric Artery
TASH	Tikur Anbessa Specialized Hospital

• Introduction

The abdominal aorta (AA) is the largest vessel in the abdominal cavity originating at the hiatus of the diaphragm at the level of the twelfth thoracic vertebra and descends anterolateral to the lumbar vertebrae to end at the lower border of the 4th lumbar vertebra, slightly to the left of the midline and bifurcates into two common iliac arteries(1, 2). Its length in adults is approximately 13cm(2). The diameter of the AA and common iliac arteries is important to be evaluated in abdominal computed tomography (CT) scans since it is frequently affected by vascular disorders. These disorders include aortic aneurysm, aortic dissection, atherosclerosis, and connective tissue disorders(3).

A growing body of literature indicates that vascular diseases contribute to the high overall cardiovascular morbidity and mortality and so there is an increased demand for interventional procedures. Cardiovascular diseases are the major cause of death in the majority of the developed countries and many developing countries(4, 5). Although various imaging modalities such as Ultrasonography (USG) & CT are relatively available in sizeable health institutions in our country and they have changed patient management during recent years particularly in affluent countries(5), allowing more rapid diagnosis and decision making, the overall clinical care of otherwise healthy adult population still gives a little emphasis to the cardiovascular screening with radiologic imaging modalities.

Although radiologic evaluation of the AA and common iliac arteries can profoundly help in the diagnosis of these potentially asymptomatic vascular disorders (particularly aneurysm and atherosclerosis) and for stent graft size selection for endovascular procedures, there is a paucity of previous studies that evaluate the diameter of AA and common iliac arteries in Ethiopian adult population in general. Thus, this study is aimed to assess the mean diameter of AA and common iliac arteries measured on abdominal CT scan at Tikur Anbessa Specialized Hospital (TASH) and its associations with some clinical parameters such as sex, age, and body mass index (BMI).

The health sector transformation plan, in line with our country's second growth and transformation plan, has set ambitious goals to improve equity, coverage, and utilization of essential health services, improve quality of healthcare, and enhance the implementation capacity of the health sector at all levels of the system. In line with this, the integration of imaging techniques for the screening of cardiovascular diseases will greatly salvage the overall health cost incurred by these asymptomatic vascular disorders. Evaluation of the abdominal aorta and common iliac artery diameters will be of irreplaceable help in the early detection of these potentially fatal aortic abnormalities and allow physicians to make better clinical decisions for

the best end of clients. More importantly, recognizing the normal abdominal aortic and common iliac arterial caliber will be highly useful for interventional radiologists and vascular surgeons to procure appropriate stent graft size for the Ethiopian population and make better choices of graft size for vascular surgeries. Hence, being cognizant of the average aortic & common iliac artery diameters, particularly as a function of certain clinical parameters, will be very helpful for the subspecialists to super select stent graft sizes.

Moreover, it will reinforce radiologists to give due emphasis to AA and common iliac artery caliber size during their routine scanning and documentation. Furthermore, it will guide health policymakers and other concerned stakeholders to devise strategic programs on inculcating imaging-assisted cardiovascular screening protocol in candidate adult populations and make evidence-based procurement of stent grafts. Finally, the findings obtained from this study will serve as a baseline for other researchers for further in-depth studies. The recent introduction of vascular surgery fellowship training and vascular interventional procedures are also pushing factors to perform such bassline studies.

So, the purpose of this study is to investigate the mean diameter of AA and common iliac arteries and the factors associated with it measured on abdominal CT scans in TASH.

• Objectives

• General Objective

To assess the mean diameter and associated factors of AA and common iliac artery diameters on abdominal CT scan of Ethiopian adults visiting TASH, Addis Ababa, Ethiopia.

• Specific Objective

- To determine the mean diameter of AA on abdominal CT scan of Ethiopian adults visiting TASH, Addis Ababa, Ethiopia.
- To determine the mean diameter of common iliac artery diameters on abdominal CT scan of Ethiopian adults visiting TASH, Addis Ababa, Ethiopia.
- To assess the factors associated with AA and common iliac artery diameters on abdominal CT scan of Ethiopian adults visiting TASH, Addis Ababa, Ethiopia.

Methods

Study Design and period

An institution-based cross-sectional prospective study design was conducted from 1 June 2020 – 31 August 2020 and this period was chosen based on convenience considering the significant patient load reduction due to the COVID-19 pandemic.

Study area

The study was conducted in TASH, which is located in Addis Ababa, the capital city of Ethiopia. It is the largest & oldest public hospital in the country providing a high level of clinical care for millions of people and training to health science students from different parts of the country and the Horn of Africa. The hospital is selected for this study because it provides relatively a large size of population from different parts of the country with a range of radiologic facilities. The Imaging department of TASH is among the most commonly visited imaging units in the country. On average, at least one thousand CT-scan imaging are done every month (of which around 300 are abdominal CT scans).

- Source data

The source population of this study was all adult patients referred from any unit of the TASH for routine diagnostic abdominal CT scans. All patients who were referred to the radiology department for abdominal CT examination for non-vascular indication during the specified period were taken as the study population

- Inclusion and exclusion criteria

Inclusion criteria

- Clients who were 18 years old and above referred from all departments for abdominal CT for a non-major vascular indication like an abdominal aortic aneurysm or aortic stenosis were included in the study.

Exclusion criteria

- Clients who were diagnosed of chronic major vascular disease like aortic aneurysm or aortic stenosis

- Clients had any huge abdominal mass compressing the aorta

- Clients who were in acute cardiorespiratory distress

- Clients who had depressed mentation

- Clients of non-Ethiopian descendant

- Sampling procedure

A convenience nonprobability sampling method was used. All adult patients who came for abdominal CT scan evaluation for non-major vascular indications and who fulfill the inclusion criteria from June 1st to August 31st were included in the study.

- Variables in the study

Dependent variable

- Anteroposterior diameter of AA at aortic hiatus level
- Anteroposterior diameter of AA at supra renal level
- Anteroposterior diameter of AA at infra renal level

- Transverse diameter of AA at aortic hiatus level
- Transverse diameter of AA at supra renal level
- Transverse diameter of AA at infra renal level
- Anteroposterior diameter of right common iliac artery
- Anteroposterior diameter of left common iliac artery
- Transverse diameter of right common iliac artery
- Transverse diameter of left common iliac artery

Independent variables

- Demographic characteristics such as sex, age, weight, height, BMI, BSA
- Clinical profile of the patient including cardiac disease, diabetes mellitus, hypertension, substance use
- Strong family history of diagnosed vascular disease

Operational definition

- Aortic hiatus or T12 level aortic diameter: stands for the maximal diameter of the aorta from the outer-to-outer layer at aortic hiatus or at T12 level.
- Suprarenal aortic diameter: stands for the maximal diameter of the aorta from the outer-to-outer layer at the mid-level between the superior mesenteric artery (SMA) and renal artery.
- Infrarenal aortic diameter: refers to the maximal diameter of the aorta from the outer-to-outer layer at the mid-level between the lower renal artery and aortic bifurcation.
- Common iliac artery diameter: refers to the maximal diameter of the common iliac artery from the outer-to-outer layer at the mid-level between the aortic bifurcation and the origin of the internal iliac artery.

- Data collection tools and techniques

Data was collected from CT scan unit of Radiology department of TASH starting from June 1st, 2020 up to August 30th, 2020. A structured questionnaire containing closed ended questions specifically designed for the study was used for data collection. The questionnaires were prepared by reviewing literatures used in this study and related studies done in other countries and try to assess demographic factors, clinical factors, and CT scan parameters. The demographic and clinical factors were directly interrogated from the client after obtaining informed consent while the CT scan findings were documented using a structured checklist.

The data was collected by two trained medical radiation technologists under close supervision and facilitation by the principal investigator.

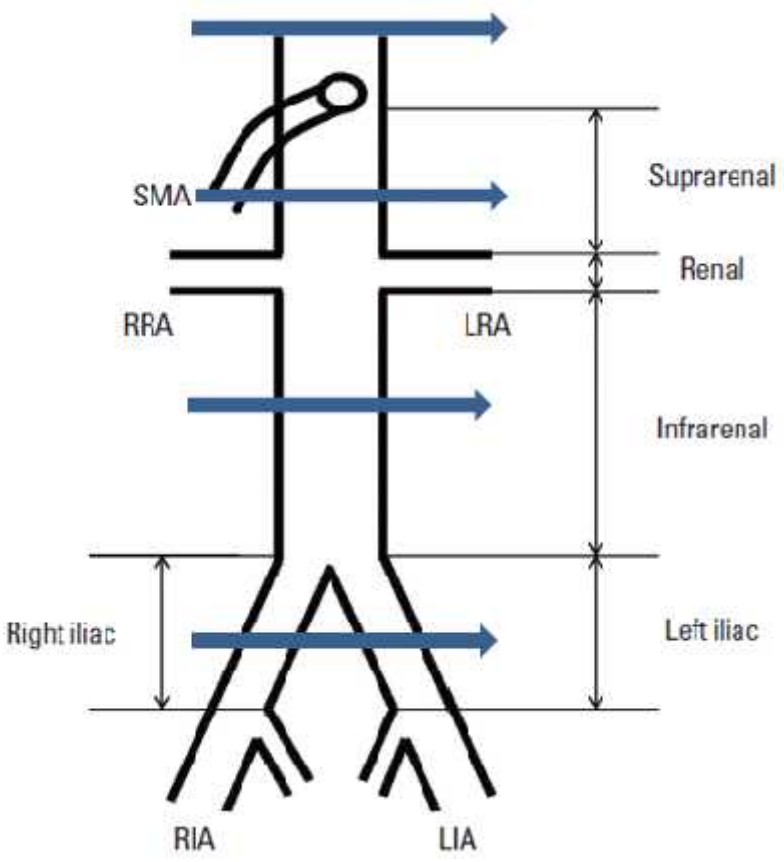

Figure 1: Levels of the abdominal aorta and common iliac arteries measurement (Source.—Modified from reference 12)

Aortic diameter was measured at three levels and both sides of the common iliac arteries diameter were measured at one level (light blue arrows). SMA, superior mesenteric artery; RRA, right renal artery; LRA, left renal artery; RIA, right iliac artery; LIA, left iliac artery.

CT scanning techniques and measurement

Abdomen CT was performed with 64 slice GE optima CT with a scan time of 0.6 second with slice thickness of 5 mm. In order to minimize motion artifacts, patients were instructed to breathe at full inspiration and held his/her breathe for 1 s during real time scanning.

The original series of abdomen CT which were taken with a slice thickness of 5 mm were sent to PACS (picture archiving and communication system) workstation and images were reviewed by scrolling on workstation. Using common measuring tool, the size of AA and common iliac arteries were measured at four distinct points: the aortic hiatus, midlevel between the SMA and renal artery, midlevel between the lower renal artery and aortic bifurcation, and midlevel between the aortic bifurcation and the origin of internal iliac artery, as depicted by figure 1.

- Data quality management

The questionnaire used to collect data were prepared by the principal investigator in English version. Brief training for the data collectors about the process of data collection was given before the process of data collection. Close supervision was there during data collection and questionnaires were double-checked daily for consistency and completeness by data collectors and principal investigator.

- Methods of data analysis

Data entering, coding and clearing for the quantitative data was performed using Epi-info version 7.2 and the analysis was done using SPSS version 22. Frequency and cross tabulation were used to check for missed value and variables. The demographic & clinical characteristics of participants were computed by using simple descriptive statistics (mean, percentage, frequencies, and standard deviation). Pearson correlations was applied to calculate associations of aortic diameter with age, weight, height, BMI at each level of aortic measurement. To analyze inter-group differences, student's t-test and one-way ANOVA were used to compare the mean of aortic measures. P-value of <0.05 and 95% confidence level was used as a difference of

statistical significance. Finally, the study finding was presented using diagrams, tables and figures.

- ### Ethical Considerations

Ethical clearance was obtained from research and ethics committee of the department of radiology. After this, introduction & familiarization of the data collectors with team unit was secured. All the study's participants were informed about the purpose of the study and their right to refuse not to participate in the study, which was then followed by obtaining informed written consent before administering each questionnaire. Then, the purpose of the study was briefly explained for the respondents and informed consent was obtained. The participants were well informed that participation was voluntary, and that they could stop the interview at any time without repercussions. The questionnaires were kept anonymous and confidential.

• Results

- ### Sociodemographic characteristics of the study participants

A total of 136 patients were included in the study, of which, 55 (40.4%) of the participants were males and 81 (59.6%) were females. The age of participants ranged from 23 to 77 with a mean of 48.4±13.23 years (Table 1). In the current study, the mean height of the study participants in meters was 1.63±0.09 (Figure 2). The mean weight of the participants was 59kg±12.6kg (Figure 3).

Table 1: Sociodemographic data of patients with abdominal aortic measurements done in Tikur Anbessa Specialized Hospital following an Abdominal Computed Tomography, 2020

Variables	Categories	Number	Percentage (%)
Sex	Male	55	40.4
	Female	81	59.6
	Total	136	100
Age groups	20 – 30 years	16	11.8
	31 – 40 years	27	19.9

	41 – 50 years	36	26.5
	51 – 60 years	32	23.5
	61– 70 years	21	15.4
	71 years and above	4	2.9
	Total	136	100.0

Figure 2: Frequency distribution by age category showing almost half of the participants are in age range of 41 to 60 years of age.

As depicted in figure 3, the height distribution ranges from 1.36 to 1.90 meter with a mean height being 1.64±.10 whereas the graphical weight distribution shows minimum and maximum measurements of 35 and 110, respectively with mean of 59.68±12.06 kg (Fig. 2).

Figure 3: Height and Weight distributions of patients with abdominal aortic measurements done in Tikur Anbessa Specialized Hospital following an Abdominal Computed Tomography, 2020

- Clinical findings

In the current study, 4 (2.9%), 6 (4.4%), 8 (5.9%) and 12(11%) of the patients had cardiac disease, diabetes mellitus, hypertension and family history of vascular disease, respectively.15 (11%) of the study participants were alcohol drinkers, while 5 (3.7%) were smokers (Table 2).

Table 2: Distribution of risk factors affecting aortic diameter in patients with abdominal aortic measurements done in Tikur Anbessa Specialized Hospital following an Abdominal Computed Tomography, 2020

Variables	Categories	Frequency	Percentage
Cardiac Disease	Present	4	2.9%
	Absent	132	97.1%
	Total	136	100%
Vascular disease (Family History)	Present	12	8.8%
	Absent	124	91.2%
	Total	136	100%
Hypertension	Present	8	5.9%
	Absent	128	94.1%
	Total	136	100%
Diabetes Mellitus	Present	6	4.4%
	Absent	130	95.6%
	Total	136	100%
Alcohol consumption	Present	15	11%
	Absent	121	89%
	Total	136	100%
Smoking	Present	5	3.7%
	Absent	131	96.3%
	Total	136	100%

- Aortic and common iliac artery diameter measurements

At the level of the aortic hiatus (T12), the average anteroposterior diameter was 2.13cm ±0.25cm and the transverse diameter was 2.14cm±0.25cm (Table 3).

At the level midway between the SMA and renal arteries, the average transverse diameter was 1.92cm±0.23cm and the average anteroposterior diameter was 1.89±0.25cm.

At the level midway between the renal arteries and the aortic bifurcation, the average anteroposterior diameter was 1.62cm±0.19cm. And the average transverse diameter was 1.63±0.2cm.

At the level midway between the aortic bifurcation and the termination of the common iliac arteries, the mean anteroposterior and transverse diameters of the right common iliac artery were 1.1cm and 1.12cm, respectively.

At the level midway between the aortic bifurcation and the termination of the common iliac arteries, the mean anteroposterior and transverse diameters of the left common iliac artery were 1.09cm and 1.1cm, respectively.

Table 3: Anteroposterior and transverse abdominal aortic and common iliac arteries diameter at different anatomic levels in Tikur Anbessa Specilaized Hospital, 2020

Anatomic level	Dimensions	Male (n=55) Mean ± SD (cm)	Female (n= 81) Mean± SD (cm)	Total (n = 136) Mean± SD (cm)
Aortic hiatus	Anteroposterior	2.27 ± 0.24	2.04 ± 0.22	2.13 ± 0.25
	Transverse	2.30 ± 0.25	2.03 ± 0.19	2.14 ± 0.25
	Average	2.28 ± 0.24	2.03 ± 0.20	2.13 ± 0.25
Supra renal	Anteroposterior	2.01 ± 0.23	1.81 ± 0.23	1.90 ± 0.25
	Transverse	2.04 ± 0.21	1.83 ± 0.21	1.92 ± 0.23
	Average	2.03 ± 0.21	1.82 ± 0.21	1.91 ± 0.23
Infra renal	Anteroposterior	1.75 ± 0.16	1.53 ± 0.16	1.91 ± 0.19
	Transverse	1.77 ± 0.16	1.54 ± 0.15	1.63 ± 0.19
	Average	1.76 ± 0.16	1.54 ± 0.15	1.63 ± 0.19
Right common iliac	Anteroposterior	1.21 ± 0.15	1.02 ± 0.12	1.10 ± 0.16
	Transverse	1.23 ± 0.15	1.05 ± 0.11	1.12 ± 0.16
	Average	1.22 ± 0.15	1.04 ± 0.11	1.11 ± 0.16
Left common iliac	Anteroposterior	1.20 ± 0.16	1.02 ± 0.12	1.09 ± 0.16
	Transverse	1.20 ± 0.15	1.03 ± 0.11	1.10 ± 0.15
	Average	1.20 ± 0.15	1.03 ± 0.11	1.10 ± 0.16

- Factors associated with aortic and common iliac arteries diameter

The mean anteroposterior and transverse aortic and common iliac arteries diameter had significant positive correlation ($p<0.05$) with age, weight, height and BMI as shown in Table 4.

Table 4: Correlation of aortic and common iliac arteries diameter with age, weigh.t, height and BMI among adult patients who undergone Abdominal Computed Tomography in Tikur Anbessa Specialized Hospital, 2020.

Correlations						
		age	weight in kg	height in meter	BMI	BSA
Aortic diameter at Aortic Hiatus level	Pearson Correlation	.446**	.372**	.394**	.143	.427
	Sig. (2-tailed)	.000	.000	.000	.097	.000
	N	136	136	136	136	136
Aortic diameter at supra renal level	Pearson Correlation	.353**	.409**	.423**	.164	.467
	Sig. (2-tailed)	.000	.000	.000	.057	.000
	N	136	136	.136	136	136
Aortic diameter at Infra renal level	Pearson Correlation	.360**	.536**	.519**	.236**	.600
	Sig. (2-tailed)	.000	.000	.000	.006	.000
	N	136	136	136	136	136
Right common iliac artery	Pearson Correlation	.305**	.582**	.532**	.268**	.648
	Sig. (2-tailed)	.000	.000	.000	.002	.000
	N	136	136	136	136	136
Left common iliac artery	Pearson Correlation	.258**	.613**	.526**	.306**	.678
	Sig. (2-tailed)	.002	.000	.000	.000	.000
	N	136	136	136	136	136
Age	Pearson Correlation	1	.043	-.002	.052	.035
	Sig. (2-tailed)		.622	.978	.544	.687
	N	136	136	136	136	136
weight in KG	Pearson Correlation	.043	1	.365**	.814**	.973
	Sig. (2-tailed)	.622		.000	.000	.000
	N	136	136	136	136	136
height in meter	Pearson Correlation	-.002	.365**	1	-.231**	.564
	Sig. (2-tailed)	.978	.000		.007	.000
	N	136	136	136	136	136
BMI	Pearson Correlation	.052	.814**	-.231**	1	.666

	Sig. (2-tailed)	.544	.000	.007		.000
	N	136	136	136	136	136
BSA	Pearson Correlation	.687	.973	.564	.666	1
	Sig. (2-tailed)	.035	.000	.000	.000	
	N	136	136	136	136	136

**. Correlation is significant at the 0.01 level (2-tailed)

The result of independent samples t-test showed the presence of statistically significant difference between the sex of the patient and the aortic and common iliac diameter at all of the anatomical levels measured with male patients having a larger mean aortic and common iliac size compared to the females (Table 5).

Table 5: Summary of the independent samples t-test between aortic and common iliac arteries diameter and sex of patients who undergone Abdominal Computed Tomography in Tikur Anbessa Specialized Hospital, 2020

Independent Samples Test								
		t-test for Equality of Means						
		T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Aortic Hiatus	Equal variances assumed	6.670	134	.000	.24945	.03740	.17548	.32342
	Equal variances not assumed	6.440	101.555	.000	.24945	.03873	.17262	.32629
supra renal	Equal variances assumed	5.640	134	.000	.20674	.03666	.13424	.27924
	Equal variances not assumed	5.645	116.443	.000	.20674	.03662	.13420	.27928
Infra renal	Equal variances assumed	8.359	134	.000	.22341	.02673	.17055	.27628

	Equal variances not assumed	8.296	113.038	.000	.22341	.02693	.17006	.27676
Right iliac	Equal variances assumed	8.521	134	.000	.18756	.02201	.14403	.23110
	Equal variances not assumed	7.983	89.595	.000	.18756	.02349	.14088	.23424
left Iliac	Equal variances assumed	7.691	134	.000	.17393	.02262	.12920	.21866
	Equal variances not assumed	7.244	91.634	.000	.17393	.02401	.12625	.22162

Age was found to have a statistically significant association with aortic (at all levels) and right common iliac diameter with increasing diameters being detected as the age of the participant increased. The left common iliac artery did not show any statistically significant association with age (Table 6).

Table 6: Mean diameter of abdominal aorta by age category at different anatomic levels in Tikur Anbessa Specialized Hospital, 2020

Age in years	Number	Aortic hiatus level Mean ± SD (cm)	Suprarenal level Mean ± SD (cm)	Infra renal level Mean ± SD (cm)	Mid Right common iliac artery Mean ± SD (cm)	Left common iliac artery Mean ± SD (cm)
20- 30	16	1.96±.22	1.74±.19	1.53±.16	1.04±.13	1.04±.13
31- 40	27	2.03±.24	1.85±.218	1.54±.20	1.07±.13	1.06±.14
41 - 50	36	2.11±.23	1.89±.23	1.62±.16	1.09±.16	1.08±.16
51 - 60	32	2.21±.22	1.98±.24	1.69±.19	1.16±.16	1.14±.17
61-70	21	2.29±.22	2.00±.20	1.6±.18	1.14±.15	1.12±.13
>70	4	2.26±.25	2.03±.13	1.74±.19	1.27±.15	1.24±.19
Total	136					

Table 7: Normal diameter of the abdominal aorta by BMI category at the different anatomic levels

BMI	Number	Aortic hiatus Mean ± SD (cm)	Suprarenal Mean ± SD (cm)	Infra renal Mean ± SD (cm)	Right Iliac Mean ± SD (cm)	Left Iliac Mean ± SD (cm)
< 18.5	25	2.08 ± 0.24	1.81 ± 0.22	1.55 ±0.16	1.02 ± 0.14	0.98 ±0. 11
18.5 – 24.9	77	2.13 ± 0.26	1.90 ±0.23	1.61 ±0.19	1.12 ±0.14	1.10 ±0.15
25 – 29.9	25	2.16 ± 0.21	1.96 ± 0.20	1.67 ± 0.16	1.13 ± 0.13	1.13 ±0.12
30 – 34.9	7	2.15 ± 0.26	1.98 ± 0.27	1.74 ±0.24	1.19 ± 0.25	1.17 ±0.214
≥35	1	2.22	1.83	1.67	1.09	1.005

• Discussion

Our study showed the mean diameter of the abdominal aorta at both suprarenal and infrarenal levels and also bilateral common iliac arteries. The suprarenal abdominal aorta anteroposterior mean diameter was 2.01 ± 0.23 cm in males and 1.81 ± 0.23 cm in females while transverse

mean diameter was 2.05 ±0.21 cm in males and 1.83 ±0.21 in females. The infrarenal abdominal aorta anteroposterior diameter was 1.75cm ±0.16cm in males and 1.53cm ± 0.16cm in females while the average transverse diameter was 1.77 cm±0.16cm in males and 1.54cm ±0.15cm in females. The right Common iliac artery anteroposterior diameter was 1.21 ± 0.15cm in males and 1.02 ± 0.12cm in females while transverse diameter was 1.23±0.15cm in males and 1.05 ± 0.11cm in females. The Left common iliac artery diameter was1.20 ± 0.16cm in males and 1.02 ±0.12cm in females while the mean transverse diameter was 1.20 ± 0.15cm in males and 1.03 ±0.11cm in females.

The aorta is the largest artery in the body, arising from the heart, distributing oxygenated blood throughout the body. There is variation in the normal size of the abdominal aorta. The average size of the abdominal aorta for Ethiopian adults at different age groups was not determined before. Knowing the normal size of the abdominal aorta enables the diagnosis of many vascular diseases particularly by evaluating the size of the abdominal aorta with the mean size of the specific population and the change in size over time too.

Even if most radiological modalities are used to evaluate the abdominal aorta, especially Ultrasound and MDCT. Because of the retroperitoneal location of the abdominal aorta and overlying bowel gas together with operator dependability of ultrasound examination, MDCT is now a widely used non-invasive technique to investigate the aorta(6). Moreover, a higher degree of precision cannot be made with ultrasound, and ultrasound measurement of the abdominal aorta and iliac arteries may give higher or lower values compared with MDCT evaluation(7, 8). there is also marked interobserver and intra-observer variability with ultrasound measurements(9, 10). Detailed anatomy of the abdominal aorta and its branches can be demonstrated on axial and also on thin-section reconstructed images at different planes. In addition, the use of 3D and volume rendering applications on advanced CT workstations makes MDCT a popular modality for aortic evaluation(11).

Our studies and most other research showed gender differences in abdominal aortic size at all levels with mean aortic size in males being larger than females. Even if most of our results have similarities with other studies done in Africa and Asian countries(12-14), but still there are variations in the mean aortic diameter at different levels with body surface area, BMI and also show variation with racial differences(15, 16). The progressive increment in the size of the

abdominal aorta with age in both males and females in our study is also in line with the fact in most kinds of literatures (12, 13, 16). This tells us that we need to determine local reference ranges for abdominal aortic size which enables us to easily pick different vascular abnormalities in a specific population. Establishing a normal reference also will be helpful for selecting the appropriate stent size for vascular interventional procedures which will avoid unnecessary resource wastage and avoid complications arising from inappropriately used stent sizes(17). Behavioural factors like alcohol consumption were found to have a statistically significant association with the aortic and iliac diameters at all levels with patients having a history of alcohol consumption showing increased aortic diameter at all levels compared with those who didn't give those histories. This was also true in other similar studies. In addition, the amount of alcohol consumption was also shown to have a direct relationship with the aortic size; there was a stepwise increase in aortic dimension at all levels with increase daily consumption(18). The presumed mechanism of alcohol being dysregulation of the Renin-Angiotensin-Aldosterone mechanism(19). The other behavioural factor included was smoking which does not show any significant association with aortic diameters at all levels but the availability of very few smoking individuals in the study might be the limiting factor.

Common iliac dimensions in our study showed slight variation with other similar studies done in Korea and Norway but most of the other studies used ultrasound to determine iliac artery dimensions(16, 20), unlike our study which used post-contrast CT which partly explains the variation.

With the objective of early detection and management of abdominal aortic aneurysms to reduce the morbidity and mortality associated with complications, many countries introduced screening programs. This study also is a crucial step before introducing screening programs by providing normal dimensional data of the aorta and common iliac arteries in both men and women.

• Conclusion

In this study, the mean transverse diameter of suprarenal aorta was 2.04 ± 0.21cm in males and 1.83 ± 0.21 cm in females while infrarenal one was 1.77 ± 0.16cm in males and 1.54 ± 0.15cm in females. It was also found that alcohol consumption, age, sex and BSA were

statistically significant factors identified in association to larger size of the diameter of the aorta and common iliac artery. This study showed that diameters of aorta were equivalent in diameter to study done in the Sudanese population our neighboring country but lower than those previous studies in Norway and Korea.

- Recommendation

The authors recommend a multicentre large-scale study to address geographic and ethnic variation.

- Limitation of the study

This is a single institution-based study and may not represent the general population but provides a baseline for further large-scale studies which may include geographic and ethnic variation. Small sample size. In addition, risk factors that showed a significant correlation with aortic and iliac diameters were not quantified.

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