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RESEARCH ARTICLE

MEASUREMENT THE DIAMETER OF ABDOMINAL AORTIC AND FEMORAL ARTERY IN CTA USING MDCT

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ABSTRACT

The objective of this clinical study was to establish normal values of femur artery dimension using Multi Detector Computed Tomography, and to find the effect of gender on the size of the femoral artery. Abdominal part (aorta at bifurcation) and femoral artery was measured at three sites in the femur of 100 healthy subjects using RadiAnt DICOM viewer system. The study showed that the dimension of abdominal aorta and the right and left femoral artery its slightly bigger in male than female in average it was 16.74 to 16.17 and for right and left side; femoral artery bigger in male than female in average 8.25 to 7.39, all these differences were inconclusive using t-test except the medium (0.047) and upper right femoral artery (0.003). the results also showed that there is strong correlation between the right and left femoral artery; concerning the lower, medium and upper femoral artery 0.78, 0.88 and 0.66 respectively, and in paired t-test there is no significant difference between medium, upper right and left femoral artery at p =0.05while lower part of the femoral artery concerning the right and left side showed significant differences p = 0.02.The important impression in this study is that the diameter of the femoral part (lower, medium and upper) can be estimated from the size of the aorta at bifurcation as normal dynamic, sine the size at bifurcation was normal.

INTRODUCTION

The incidence of abdominal aortic aneurysms is increasing and the fate of an individual aneurysm is unclear. However, the risk of growth and rupture is related to increasing size and most surgeons are in favour of treating aneurysms above 50-55 mm surgically. Smaller aneurysms are usually treated conservatively with follow-up by ultrasonography. Since rupture may occur even in asymptomatic and relatively small aneurysms, early detection and validation are considered to be indispensable for further improvement in the management of the disease. However, several definitions of abdominal aortic aneurysms are used at present, which produce very different results in evaluating the incidence and prevalence of the disease (Moiler, 1992). One of the basic problems encountered is defining the normal diameter of the abdominal aorta, which makes it impossible to follow the advice of the Society for Vascular Surgery and the International Society for Cardiovascular Surgery (SVS/ISCVS), which defines an aneurysm as a 50% dilatation of a normal artery (Johnstone, 1991).

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The common femoral artery (CFA) is, after the popliteal artery, the most common peripheral site of general dilatation or aneurysmal formation, with a frequency of 1/10 of the aorta. Femoral aneurysms are often bilateral, and there is a relation between aneurysms in the femoral artery and aneurysms in other sites of the arterial system. Recently, an increasing diameter was found in the abdominal aorta and the popliteal artery with age in healthy volunteers. Further, the diameter also was shown to be affected by body size and sex (Sonesson, 1994; Sandgren, 1998; Pearce, 1993 and Davies, 1977). Studies regarding the diameter of the CFA are sparse, without any reliable data that concern the factors influencing the diameter (Lewis *et al*., 1986; Kawasaki ert al., 1987). This knowledge, however, is of fundamental importance in the study of aneurysmal disease. The aimof this study was to measurement right and left common for femoral artery and Bifurcation in a normal healthy population in relation to lower left aortic, medium left aortic, upper left aortic, lower right aortic, medium right aortic, upper right aortic. Many patients with popliteal aneurysms are asymptomatic at the time of diagnosis; symptomatic patients can present with a lower-extremity ischemia, which can manifest as claudication, rest pain, or severe ischemia associated with thrombosis or embolization. As a matter of fact, patients with popliteal aneurysms have a risk of limb-threatening thrombotic complications, with embolization and above all rupture, with an incidence of 18-31% (Dawson *et al*., 1991 and Beregi *et al*., 1997).

MATERIAL AND METHODS

The study was performed on 100 consecutive patients, in three hospitals in Khartoum state, using different CT All investigations were done with the subject in the supine position. The maximal anteroposterior diameter was registered with the CT machine for bifurcation and the right and left branches. CTA allows identificati on of the aneurysm and differential diagnosis from ectasia (caliber increasing less than 50%), the description of the lesion, evaluating location, length, extension, transverse diameter (valuated always perpendicularly to major vascular board), presence of calcifications and location of thrombotic apposition (concentric/ eccentric) measuring its maximum thickness, evaluating the look of its edges and excluding the possible presence of iperdensity that can suggest an instable nature of the thrombus.

MDCT technique: For the evaluation of the lower extremity arteries, 64-detector multi-sliced CT (Toshiba Aquilion, Toshiba Medical systems, Tokyo, Japan) was used. Every patient was placed in supine position and in a neutral position with the feet in the gantry first. The area evaluated was extended from the suprarenal aorta to the ankle joint. The scanning parameters were set as follows: tube voltage: 120 kV; effective tube flow: 250 m As, rotation time: 0.4 s, table speed: 29 mm/s; pitch: 0.844 mm; section thickness: 0.5 mm, and reconstruction interval: 0.5–1 mm. To achieve optimal contrasting in the vascular structures, automatic bolus tracking was used in the determination of the delay time. At the level of the renal artery orifice, ROI was placed. After the injection of contrast material, scanning was automatically started when the density in the abdominal aorta reached the level of 180 HU. Scanning time was about 32 s; therefore, we injected approximately 130 mL of contrast medium (Ultravist 360 mg or Scanlux 300 mg The reconstruction field of view was 34 cm, and the matrix size was 512 × 512, resulting in a voxel size of 0.6 × 0.6 × 0.6 mm; a mean of 5720 transverse images (range, 5160 - 6225 images) was generated for each patient. Image reconstruction was routinely performed with a medium soft-tissue algorithm (Vitrea workstation).

RESULTS

Table 1. measurement of dimensions of abdominal aorta and bifurcation to left and right femoral artery according to gender

	Gender	*Mean*	*STD*	*Min*	*Max*
Lower Lt	*Male*	*7.78*	*1.121*	*5*	*10*
	Female	*5.57*	*1.161*	*5*	*10*
Medium Lt	*Male*	*8.07*	*1.238*	*5*	*10*
	Female	*7.83*	*1.114*	*6*	*10*
Upper Lt	*Male*	*8.41*	*1.279*	*5*	*11*
	Female	*7.78*	*1.043*	*6*	*10*
Lower Rt	*Male*	*8.33*	*1.330*	*5*	*11*
	Female	*7.83*	*0.984*	*6*	*10*
Medium Rt	*Male*	*8.33*	*1.209*	*5*	*10*
	Female	*7.70*	*1.118*	*6*	*10*
Upper Rt	*Male*	*8.59*	*1.083*	*7*	*11*
	Female	*7.61*	*1.118*	*6*	*10*
Bifurcation	*Male*	*16.74*	*1.810*	*13*	*22*
	Female	*16.17*	*1.850*	*12*	*20*

Table 2. Differences in means for femoral artery measurements, left and right (lower, medium and upper) and Bifurcation in respect to gender using t-test

	t-test for Equality of Means	
	t	p-value (2-tailed)
Lower Lt	1.004	.320
Medium Lt	1.041	.303
Upper Lt	1.999	.051
Lower Rt	1.923	.060
Medium Rt	2.038	.047
Upper Rt	3.139	.003
Bifurcation	.953	.345

Table 3. Measurement of dimensions of abdominal aorta at bifurcation to left and right femoral artery all patients

Paired Samples Statistics			
		Mean	Std. Deviation
Pair 1	LowerLt	7.740	1.1075
	LowerRt	7.992	1.1089
Pair 2	MediumLt	7.896	1.0662
	MediumRt	7.968	1.1582
Pair 3	UpperLt	8.078	1.1687
	UpperRt	8.100	1.1101

Table 4. Paired samples for correlation between Left and Right measurements

Paired Samples Correlations		Correlation	Sig.
Pair 1	LowerLt & lowerRt	0.78	.000
Pair 2	MediumLt & mediumRt	0.88	.000
Pair 3	UpperLt & upperRt	0.663	.000

Table 5. show paired sample T-Test for Left and Right measurement

Paired Samples Test		t	p-value
Pair 1	Lower Lt - lower Rt	2.407	0.020
Pair 2	Medium Lt - medium Rt	0.911	0.367
Pair 3	Upper Lt - upper Rt	0.166	0.869

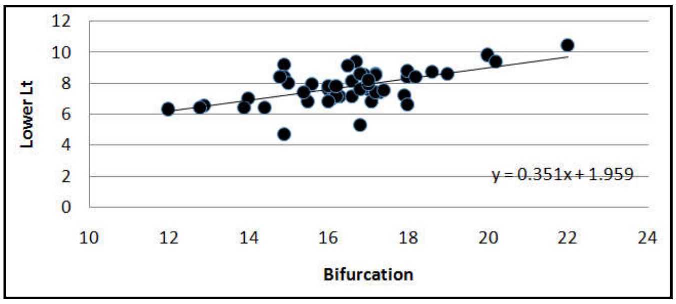

Figure 1. show correlation between bifurcation and lower left femoral artery

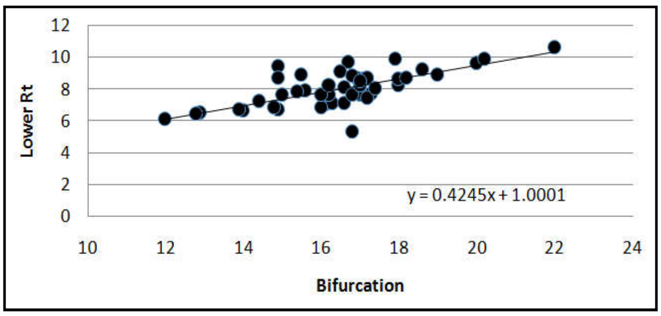

Figure 2.show correlation between bifurcation and lower Right femoral artery

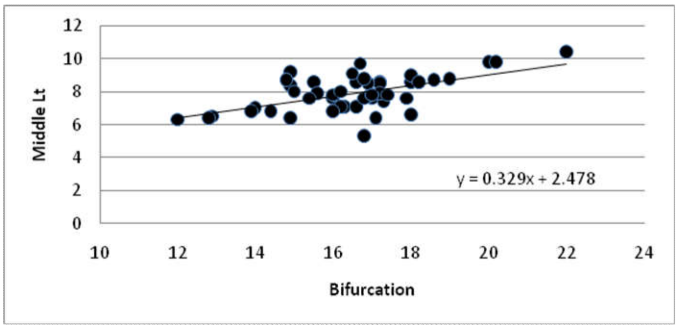

Figure 3. show correlation between bifurcation and medium left femoral artery

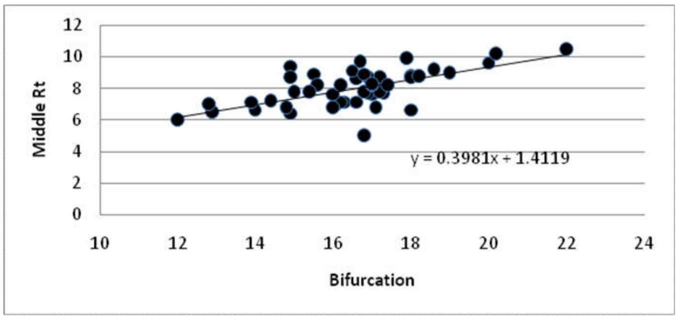

Figure 4. show correlation between bifurcation and medium Right femoral artery

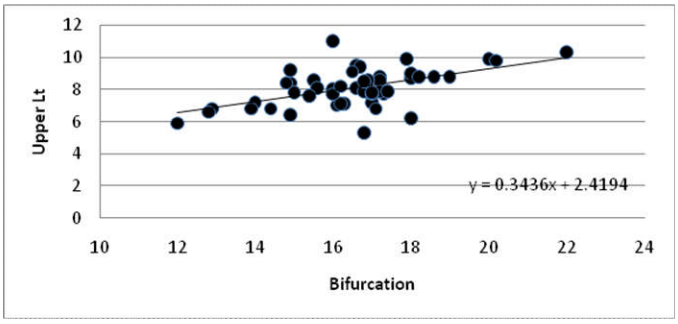

Figure 5. show correlation between bifurcation and upper left femoral artery

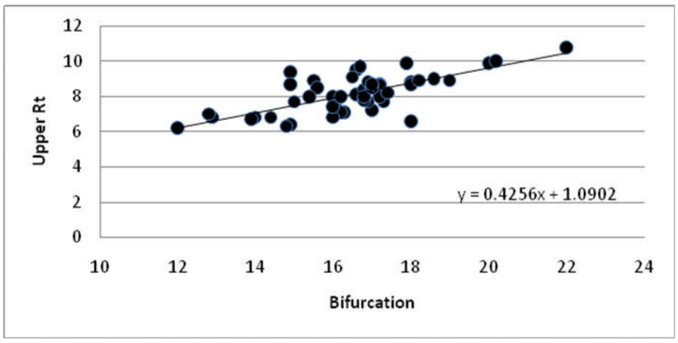

Figure 6. Show correlation between bifurcation and upper Right femoral artery

DISCUSSION

Measurement of abdominal aorta at its bifurcation as well as left and right femoral artery for 100 patients reveals that, male has slightly wider diameter than female but this differences were insignificant at p =0.05 using t-test, which means in normal patients gender has no effect on the diameter dimensions variability between the gender except for Rt upper femoral part (Table 1 & 2). The mean diameter of lower, medium and upper part of the Rt and Lt branch of the femoral artery was7.74±1.11, 7.99±1.11, 7.89±1.07, 7.96±1.16, 8.08±1.17 and 8.10±1.11 mm respectively (Table 3). These measurements showed similarity between the Rt and Lt femoral artery in the three parts, but using t-test there is a significant differences between the lower femoral part (Rt and Lt) as shown in (Table 4), but there is strong correlation between the Rt and Lt femoral branches at the lower, medium and upper parts as shown in (Table 4). The bifurcation showed inconclusive results regarding the gender; as well it has strong correlation with the Rt and left femoral artery at it is three parts (lower, medium and upper). This means we can estimate the dimension of these parts using the dimension of the bifurcation. Linear regression results showed that the rate of change in the lower Lt and Rt femoral artery increases by 0.351mm(fig 1) and 0.4245mm(fig 2) respectively for each mm of bifurcation. For the medium Lt and Rt the rate of change was 0.329mm (fig 3) and 0.398mm (fig 4) for each one mm of bifurcation as well as for the upper femoral part Lt and Rt it was 0.343mm (fig 5) and 0.425mm (fig 6) respectively for each mm of the bifurcation. All these parameters showed that there is a direct linear relationship between the femoral parts (Rt and Lt) with the bifurcation, where the diameters for any part can be estimated positively if the diameter of the aorta at bifurcation were normal.

Conclusion

The diameter of the abdominal aorta at its bifurcation to left and right femoral arteryslightly increases with gender its bigger at male than female but this was inconclusive. The femoral artery Rt and left branches at lower, medium and upper can be estimated using the following linear equations:

Equation for the regression values between the bifurcation and the:

Lower left femoral artery =(0.35×bifurcation) + 1.96
Lower right femoral artery= (0.42× bifurcation) + 1.00
Medium left femoral artery= (0.33× bifurcation)+ 2.48
Medium right femoral artery= (0.39× bifurcation) + 1.41
Upper left femoral artery= (0.34× bifurcation) + 2.42
Upper right femoral artery= (0.43× bifurcation) + 1.09

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