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Measurement of Pancreatic Volume in Saudi population Using Computerized Tomography; Age, Gender, and Height Correlation

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ABSTRACT

The current research was a descriptive cross-sectional study that deals with measuring of normal pancreatic volume in Saudi population using Computed Tomography during the period from June to September 2021. The problem of this study was there was no reference values for pancreatic volume to compares it with international ones. The aim of the study was to measure normal pancreas and to show the relations between values and individual age, gender, and height. The data collected from 60 patients with normal pancreas by data collection sheet containing all the variables and analysis by using statistical programmed for social and sciences and presented as tables and figures. The results of this study showed that, the mean of individual age, height and pancreas volume was 37.55, 168.35, and 23.27 respectively. Also, no relationship between age and volume of pancreas p-value (0.19 > 0.05) was found on this study. But there was a relationship between height and volume of pancreas p-value (0.029 < 0.05) was found on this study. The percentage between height and volume of pancreas relationships was about 74%. The significance between gender and volume show that, there is a moderate relationship between them (61%) (p-value is 0.062) and the volume values more for males (mean=23.35) than females (mean=22.75). The study recommended measuring all pancreatic diameters with larger sample size and another modality to compare the results.

Keywords: Computed Tomography; Pancreas; Diameters

Introduction

In recent years, Due to the quick growth of deep neural networks in recent years (Krizhevsky et al., 2012; Simonyan and Zisserman, 2015), computer-aided diagnostics and clinical picture processing have both advanced rapidly (CAD). This research concentrates on a crucial requirement for CAD (Havaei et al.,2017; Zhou, et al. [1]). which is the automated segmentation of tiny organs (such the pancreas) using CT-scanned images. The challenge is primarily caused by the target organs' limited volume and/or considerable anatomical diversity. In fact, researchers occasionally create a unique segmentation strategy for each organ (Al-Ayyoub, et al. [2]. Roth et al., 2015). When it comes to segmenting major organs, the pancreas is particularly challenging because it frequently exhibits a significant degree of variability in terms of its size, shape, and position (Roth, et al. [3]). and only takes up a very little portion (e.g., 0.5%0.5%) of the total CT volume. In these scenarios, the surrounding region, which makes up a significant portion of the

receptive field and contains complex and varied contents, has the potential to interfere with deep neural networks. As a result, the segmentation outcome is erroneous, particularly at the boundary zones (Zhou, et al. [4]). The pancreas is an important gland in the body. (The length of the pancreas is almost 20 cm and weighs 75-90 grams). The pancreas is located in the upper part of the abdominal cavity behind the stomach at the level of the first lumbar vertebra and the second L1 and L2 vertebrae. Pancreas extends sideways from right to left, starting from the annular portion of the duodenum until the navel (entrance) of the spleen (Sugihara and Chabot [5]). Since the pancreas is a highly concealed part of the body, diagnosing its malformations has proven to be challenging. Traditional diagnostic techniques in the past now include angiography and ultrasonography. Ultrasound is widely used because it is reliable and safe (Stuber et al., 1972). Angiography has established itself as the most trustworthy method of assessment (Lunderquist [6]). With the development of computed tomographic (CT) scanning, it is now feasible to see a healthy pancreas and identify any anomalies (Alfidi, et al. [7]). Our initial experience with a CT diagnostic of pancreatic and peripancreatic anomalies is the focus of this research. On a 4- or 8-slice GE LightSpeed scanner with a pitch range of 3 to 6, a kVp of 120 m as ranging from 240 to 360, and a nominal slice width of 5 mm at reconstructing intervals of 2.5 mm, computed tomography scans were conducted. Images were uploaded to the GE Advantage Workstation (GE Healthcare, Inc., Waukesha, Wis.; workstation version 4.0), and dimensions of the head, body, and tail of the pancreas were made in one dimension (Syed et al., 2012). Previous estimates of the average pancreatic size have varied, as evidenced by the higher values identified by (Nino-Murcia, et al. [8]). especially in comparison to those found in the investigation of (Balthazar et al., 2009). This discrepancy has been attributed to the absence of measurement techniques that would have been complicated by nearby vascular structures. As a result, the measures may be distorted and result in a higher reading than intended, demonstrating the necessity for clarity and separation between structures close to the pancreas. For this work, we used a large case collection of individuals with nonpancreatic indications to build a standard methodology by integrating and improving current measuring methodologies. When accurate pancreatic measures are required in a clinical or research situation, this data may be consulted (Papaconstantinou, et al. [9]). The aim of the study was to measure normal pancreas volume and lengths using computerized Tomography Scan in Dammam population,

(i) To correlate between volume of pancreas and individual height,

(ii) To correlate between individual age and gender with pancreatic volume,

(iii) To establishes reference values in Dammam population and compare it with international.

Materials and Methods

Study Design

A descriptive cross-sectional study. The study was conducted during the period from from June to September 2021 in king Abdelaziz hospital, Taif Saudi Arabia. Normal pancreatic size of population comes to CT department for abdominal scan with no known pancreatic disease. Data was collected with a serial number (IRB Registration Number With KACST, KSA: HAP-02-T-067) Sample size was very low, 60 patients with no known pancreatic disease.

Inclusion and Exclusion Criteria

All patients come for abdominal CT. The exclusion criteria comprise of the patient with pancreatic disease. The dependent variables were to find normal pancreatic diameters and independent variable was age, gender and height data collected using data collection sheet containing all variable.

Machine used

Axial images were obtained using a Toshiba 64 slice CT scanner, on 60 subjects who underwent abdominal CT scanning and were found to have normal pancreas and no diabetes history or other diseases affecting the pancreas. A dosage of 2 mgI kg^{-1} of iodinated contrast medium was administered. The patient was positioned in a supine position and fully inspired for the CT scans. The lungs base to the iliac crest's lower edge was the scan's coverage area. The irradiation settings were 250 mA and 120 kVp.

Method of Pancreas Measurement

Anteroposterior (AP) measures of the body and tail thicknesses parallel to the long axis of the organs were made in the pancreas section (head, body, and tail and volume) being investigated. The readings were acquired from the operator council of the CT machine (mm). The pancreatic head's AP thickness was normally measured using its actual AP parameters. The pancreas head, body, and tail were measured and assigned pancreas textural numbers (measured in Hounsfield Unit).

Statistical Analysis

SPSS version 16 for Windows was used to record and analyze all the study's data. The sex-related variations were estimated using the independent samples t-test. The relationship between the subject's age and various body characteristic factors and pancreas size was assessed using Pearson's correlation coefficient.

Results

The current study was conducted at Taif city from June to September 2021. This was a descriptive cross-sectional study conducted on the general Saudi population in short period of time. The study deal with measuring normal pancreatic volume on 60 patients. There was a relation between individual's gender and

volume of pancreas, and the female has smaller volume than male. The result of this study shows that 52 out of 60 (86%) was male while 8 out of 60 (13.3%) was females (Table 1). The study showed that the mean of age, height and volume was 37.55, 168.35, 23.27 respectively (Table 2). The descriptive statistics of the variables showed that the minimum value for age was 15 and maximum was recorded 78 followed by 155 minimum values for height and 185 maximum values. Compared to age and height the volume showed the lowest value 18 cm and highest value 29 cm. The standard deviation for age, height and volume was 11.67, 6.147 and 3.55 respectively. Furthermore, the study shows the age frequency distribution as follows (lower than 20), (20-29), (30-39), (40-49), (50-59), (60-69) and (70-79) is (1) (1.7%), (12) (20%), (30) (50%), (9) (15%), (5) (8.3%), (1) (1.7%) and (2) (3.3%) respectively (Table 3).

Table 1: Distribution of gender.

SEX					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
	Male	52	86.7	86.7	86.7
	Female	8	13.3	13.3	100
	Total	60	100	100	

Table 2: Minimum and maximum of each variable.

Descriptive Statistics					
	N	**Minimum value**	**Maximum value**	**Mean**	**Std. Deviation**
Age	60	15	78	37.55	±11.677
Height	60	155	185	168.35	±6.147
Volume (cm)	60	18	29	23.27	±3.550
N	60				

Table 3: Age frequency distribution.

Age's Class Interval	Frequency	Percent	Valid Percent	Cumulative Percent
lowest than 20	1	1.7	1.7	1.7
20 - 29	12	20	20	21.7
30 - 39	30	50	50	71.7
40 - 49	9	15	15	86.7
50 - 59	5	8.3	8.3	95
60 - 69	1	1.7	1.7	96.7
70 - 79	2	3.3	3.3	100
Total	60	100	100	

The frequency of age showed that there were more people suffering from abdominal pain and were tested through CT scan in hospital which were 30 and their percentage was half of the all-others age groups. The second most tested and reported patients was from the 20-29 group which was 12 people, and their percentage was 20% followed by 9 and 5 individuals from 40-49 and 50-59 age category. The least number patients interviewed or tested for pancreatic problem was 1 from lowest than 20 age group and 60-69. The highest cumulative percentages were 96.7, 95, and 86.7 shown by 60-69, 50-59 and 40-49 age group respectively. The Pearson correlation was carried for relation between age and volume. The analytic data showed that there was no correlation between age and volume of pancreas p-value (0.19 > 0.05) was found on this study. At a 5% level of significance, with p-value of 0.19 > 0.05, the previous studies conclude that there is no relationship between the pancreas volume and the age (Table 4). The correlation between height and volume is significant at 0.05 level when significant (2-tailed) was applied. At a 5% level of significance, with p-value of 0.029 ≤ 0.05, researchers conclude that there is a relationship between the pancreas volume and the height. The relationship between height and volume of pancreas shows that moderate relations (74%) (Table 4).

The correlation between volume and height was again carried out by putting the volume as dependent variable. The unstandardized coefficient and standardized coefficients were found out for height 0.163 and 0.281 by keeping the volume (cm^3) as dependent variable and the standard error was 0.073 which was very low. The data represent the value of lower and upper bound as 0.017 and 0.308 respectively at 95% confidence interval. The percentage between height and volume of pancreas relationships is about 74% (Tables 5A & 5B). The significance between gender and volume show that, there is a moderate relationship between them (61%) and the p-value is more for males (mean=23.35) than females (mean=22.75) (Tables 6A & 6B). There was no big difference between the standard deviation of the mean of male and female volume of pancreases. At a 61% level of significance, with p-value of 0.062< 0.05. The current study concludes that there is a relationship between the pancreas volume and the sex in light of previous studies. The independent sample Levene's test for equality of variance and t-test for equality of mean was also carried out which showed that the pancreas volume is more for males with mean = 23.35, but for females the mean is 22.75.

Table 4: Correlation between age and pancreatic volume.

Correlations			
		Age	**Volume (cm)**
Age	Pearson Correlation	1	.19
	Sig. (2-tailed)		.146
	N	60	60
Volume (cm^3)	Pearson Correlation	.19	1
	Sig. (2-tailed)	.146	
	N	60	60

Table 5A: Correlation between height and volume.

Correlations			
		Height	**Volume (cm)**
Height	Pearson Correlation	1	.281*
	Sig. (2-tailed)		.029
	N	60	60
Volume (cm)	Pearson Correlation	.281*	1
	Sig. (2-tailed)	.029	
	N	60	60

Note: *Correlation is significant at the 0.05 level (2-tailed)

Table 5B: Correlation between height and volume.

Coefficients								
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**95.0% Confidence Interval for B**	
		B	**Std. Error**	**Beta**			**Lower Bound**	**Upper Bound**
1	(Constant)	-4.096-	12.259		-.334-	.739	-28.636-	20.443
	Height	.163	.073	.281	2.234	.029	.017	.308

Note: a. Dependent Variable: Volume (cm^3)

Table 6A: Significance between gender and pancreas volume.

Group Statistics					
	SEX	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Volume (cm)	Male	52	23.35	3.591	.498
	Female	8	22.75	3.454	1.221

Table 6B: Significance between gender and pancreas volume.

Independent sample test						
		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	.062	Df	Sig. (2-tailed)
Volume (cm)	Equal variances assumed	.022	.061	.439	.062	.062
	Equal variances not assumed			.452	.061	.061

Discussion

The current study was descriptive cross-sectional research carried out in Taif city by comparing the age, height, and volume of pancreas in normal population. The study's retrospective analysis of 220 CT scans revealed that the volume of women is lower than that of men (102 females, 118 males; age 16–82, average 56) (Djuric-Stefanovic, et al. [10]). In the first published series of 41 pancreases, the computed tomography-measured mean volumes of normal pancreas were 40.4 9.3 cm3 (Von Schulz, et al. [11]). which was twice as less as in our series. Djuric-Stefanovic et al. used CT volumetry to estimate the size and volume of normal pancreas in adults. They also examined the relationship between gender, age, and body constitution as well as the volume and diameters of the pancreas, which can be measured by cross-sectional imaging. The results showed that as age increased, the size of the body, tail, and anteroposterior diameter of the pancreas also decreased moderately (Djuric-Stefanovic, et al. [10]). The analytic data showed that there was no correlation between age and volume of pancreas p-value (0.19 > 0.05) was found on this study. In research on Nepalese individuals conducted by Basnet, et al. [12]. pancreas was categorized by age and sex. The weight and height were quantitatively measured. The thickness of the pancreas differed between male and female subjects as a result, with the male individuals' pancreas being larger. Although there is correlation between height and volume of pancreas p-value (0.029 < 0.05) was found on this study. The significance between gender and volume show that, there is a moderate relationship between them (61%) and the p-value is more for males (mean=23.35) than females (mean=22.75) (Tables 6A & 6B). According to Geraghty, et al. [13]. the mean volume of the normal pancreas measured by CT volumetry in a series of 113 patients was 64.4±18.1 cm3 for females and 87.4±21.3 cm3 for males, with ranges between 22.4 and 136.6 cm^3, which was consistent with our findings. A study by Basnet, et al. [12] was done to determine the pancreas' typical size. Thus, 40 pancreases from both sexes and various age groups were gathered from four medical institutions in Kathmandu, Nepal, and studied descriptively during an eight-year period (2004–2011). Age and sex were used to categorize pancreas. The size of the pancreas differed between male and female subjects as a result, with the male subjects' pancreas being larger [14].

Conclusion

This study estimates the volume of normal pancreas in Saudi population using computerized tomography. The pancreatic volume significantly correlates with the individual sex and height but there was no correlation with age. Finally, the study recommended to estimate all pancreatic volume users computed tomography and to consider these measurements as reference values when the pancreas is to be evaluated. To validate these findings from the index and aid in a more accurate diagnosis of the pancreatic issue that caused an increase in size or a decrease in density, wider descriptive analytic analyses employing another imaging technique, like as MRI or US, are required (CT number). It is advised to employ CT scanning as a diagnostic tool for pancreatic disorders since it plays a significant role in pancreas imaging [15-19].

Ethical Approval

Ethical approval was taken from King Abdul-Aziz specialist with code (IRB registration number with KACST, KSA-HAP-02-T-067).

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