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Measurement of aorta sacral promontory distance in females on contrast enhanced CT abdomen and its correlation with Age and BMI

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Abstract

Aims and objective: To measure the aorta-sacral promontory distance among the females referred for contrast enhanced CT abdomen. **Material and methods:** A quantitative, cross-sectional study was conducted in the Department of Radiology, Narayana Supespeciality Hospital, Howrah, West Bengal, India from May 2017 to June 2018. Total of 200 patients underwent Contrast Enhanced CT abdomen. The age, height and weight of the patients were noted and aorta sacral promontory distance was determined. **Results:** The mean age was found to be 51.37 years, mean APT distance 4.61 ± 0.80 cm and mean BMI 24.88. Increase in age was correlated with decrease in APT distance but there was no correlation between BMI and APT distance. According to this study, APT distance was decreased in elderly female patients but no significant change in BMI and APT. **Conclusion:** In this study using CT, we found that as the age increased, APT distance decreased and there was no significant change in relation to BMI. Therefore, during sacral colpopexy, the surgeon should be careful and consider the aorta sacral promontory distance in the elder female patients while performing dissection.

Keywords: aorta sacral promontory distance, pelvic organ prolapse, sacral colpopexy.

Introduction

Sacral colpopexy has been consistently shown to correct vaginal vault prolapse with an anatomical success rate of 78– 100 % and a subjective cure rate as high as 92.1 %.[1, 2] However, rare but serious intraoperative complications of hemorrhage may be encountered. The need for blood transfusion occurs at a rate of 4.4 %.[1] There is the potential for vascular and organ injuries, some of which may not be recognized until postoperatively.[1, 3, 4] To avoid such complications, the surgeon should be aware of the proximity of nearby vessels such as the common iliac veins, iliac arteries, and the aortic bifurcation.[3] The location of the aortic bifurcation and sacral promontory provides anatomical orientation during complex surgical dissection. It is crucial for the surgeon to be cognizant of the potential anatomical variability in patients. In the United States pelvic floor disorders affect almost 25 % of the female population. These disorders are more prevalent in the elderly population.[5]

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As more patients are seeking definitive management for their prolapse, the number of elderly patients undergoing sacral colpopexies will likely increase. Some studies have demonstrated that with increasing age, the aorta enlarges and elongates. Elderly patients also suffer from diseases that affect the spinal column, such as osteoarthritis, osteoporosis, or degenerative disc disease, which may alter the height of the vertebral bodies.[6]Sacral colpopexy is a surgical technique for repairing pelvic organ prolapse in women. A higher BMI have been associated with increased prevalence of pelvic floor disorders.[7] Some studies have demonstrated that with increase in age, aorta enlarges and elongates.[8,9] During sacral colpopexy, likelihood of a decreased APT distance in elderly and hypertensive patients require careful identification of aorta bifurcation and sacral promontory before dissection

Therefore, this study was conducted to aid surgeons who operate for pelvic disorder for careful identification of aorta and sacral promontory before dissection to avoid complication. The specific objectives of this study were to estimate the aorta

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sacral promontory distance in female patients and to correlate aorta sacral promontory distance with age and BMI.

Material and Methods

A quantitative, cross-sectional study was conducted in the Department of Radiology, Narayana Superspeciality Hospital, Howrah, West Bengal, India from May 2017 to June 2018.

Methodology

Total 200 patients who visited for CECT scan of abdomen without pathological findings were included in the study. Measurement was performed on CECT scan of abdomen on sagittal section. Female patients aged 20 and above referred for CECT scan of abdomen without pathological finding were included in the study. Patients with sacral injury, aortic and spinal diseases were excluded in the study. The protocol parameters under CECT Protocol were as 600 ml plain water 30min before and then 400ml just before examination, Scanning area from dome of diaphragm to iliac crest, Detector collimation:0.6x128, Pitch: 0.85, mAs: 200, Contrast: Intravenous, Volume: 80-100ml at rate of 3.5-4ml/s and Recon slice and interval:5x5mm with triple phase scan delay as 15-20 sec for arterial phase, 40-60 sec for portal phase and 70-80 sec for venous phase .

In this study, measurement of aorta sacral promontory was measured by reconstructing arterial phase of the abdomen on sagittal image, point of aortic bifurcation was identified on coronal image and then distance from level of aortic bifurcation to sacral promontory was measured. Vertical distance was represented as aorta sacral promontory distance.

Patient's age, weight, height was recorded. Data was obtained and analyzed using the descriptive statistics to summarize the information, and inferential statistics (paired sample t-test) to verify if there were significant difference between patient's APT distance with age and BMI.

Statistical analysis

The recorded data was compiled entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 20 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages, means and standard deviations. Test applied for the analysis was Pearson correlation coefficient. The level of confidence interval and p-value were set at 95% and 5%.

Results

Data was collected from 200 Patients who underwent CECT scan for abdomen. Female patients were categorized into four age groups of 20-40, 40-60, 60-80, and above 80. The mean age was 51.37 years (range 20-83 years). Total patients in age groups of 20-40 years was 37%, 40-60 years was 36%, 60-80 years was 21.5% and in age group of 80 years above, number of patients were 5.5% (Table 1). As the age group increased, there was a decrease in mean APT distance. The mean APT distance was longer among the age group of 20-40 years and obese group. APT distance was short in elderly female patients and under-weight patients.

The mean aorta sacral promontory distance of age group 20-40 years was found to be 5.25±0.50cm, 40-60 years to be 5.06 ± 0.51cm, 60-80 years to be 3.80 ± 0.57 cm, 80 years above to be 2.70 ± 0.42 cm. As the age group increased, there was a decrease in mean APT distance. The mean APT distance was longer among the age group of 20-40years. Mean BMI was 24.88 (range 17.38 - 38.13). The number of patients in under-weight group (BMI<18.5) was 9 and mean APT distance was 18.12 ± 0.51cm, normal BMI group (18.5-25) was 128 with mean APT distance 22.36 ± 1.70 cm, in overweight group (25-30) was 59 and mean APT was 27.11 ± 1.42 cm, in the obese group (30 and above) there were 4 patients with mean APT distance 33.08 ± 3.12 cm. As BMI increased inpatients, there was increase in APT distance (Table 3). There was a strong negative correlation between APT and age. Increased in age was correlated with decrease in APT distance (Pearson's correlation coefficient (r) was found-0.762 between age and APT distance, p<0.01). There was no significant correlation between BMI and APT distance (Pearson's correlation coefficient (r) was found-0.014 between BMI and APT distance, p>0.01) (Table 4). Hence, age and BMI were responsible for variation in APT distance. Therefore, there was an overall significant relation between APT distances with age. There was strong negative correlation between APT distance and age (correlation coefficient (r^2) value was found to be 0.762). Increase in age leads to decrease in APT distance. There was no significant correlation between BMI and APT distance (correlation coefficient (r^2) value was found to be between BMI and APT distance.

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Table 1: Distribution of sample size according to age group

Age (in years)	Number of patients =200	%
20-40	74	37%
40-60	72	36%
60-80	43	21.5%
Above 80	11	5.5%

Table 2 Comparison of mean aorta sacral promontory distance with age

Age (in years)	Aorta sacral promontory distance (cm) mean ± standard deviation
20-40	5.25±0.50
40-60	5.06±0.51
60-80	3.80±0.57
Above 80	2.70±0.42

Table 3 Comparison of mean aorta sacral promontory distance with BMI

BMI	Number of patients	Aorta sacral promontory distance (cm) mean ± standard deviation
Underweight (<18.5)	9	18.12±0.51
Normal (18.5 to <25)	128	22.36±1.70
Overweight (25 to 30)	59	27.11±1.42
Obese (30 and above)	4	33.08±3.12

Table 4 Linear regression model for predictors of APT distance

Variable	r-value	p-value
Age	-0.762	<0.01
Body mass index	-0.014	>0.01

Discussion

The number of elderly patients undergoing surgeries for pelvic floor disorders is increasing gradually in recent years.[1] As more patients are seeking surgical treatment for pelvic prolapse, surgeons should be familiar with proximity of nearby vessels to avoid complications to the iliac artery, iliac veins and aortic bifurcation. Before a surgery, it will be beneficial for surgeons if APT distance is measured using CT scans which can prevent intraoperative complications like injury to vessels, haemorrhage, ureteral injury and enterotomy. This study showed that as the age group increases, there was significant decrease in mean APT distance. However, as BMI increased in patients, there was increase in APT distance but was not significant. APT distance was short in elderly female patients. This result agreed with the result of the study conducted by Sneha Mary Varghese, Suresh Sukumar, Abhimanyu Pradhan.[10.] From 172 subjects the mean age was 56.5 years (18-95) and mean BMI was 23.25 (range 10.8-35.7). The mean APT distance was found to be 2.7±15cm. The study also showed that as the age group increased, there was a significant decrease in mean APT distance. However, as the BMI increased in patients, there was no significant change in mean APT distance. The observation in this present study was similar with earlier research conducted by Agrawal A et al.[8] Mean age was 56.6 years and mean APT distance measured on CT was 6.3±1.02cm. This study also supported that within the increasing age group, the mean APT distance significantly decreased. With increase in age there was degeneration of intervertebral discs which shortens the vertebral column and thus a lower level of aortic bifurcation may result.[11] In the study conducted by Forbang NI et al., to find the association between cardiovascular disease and aortoiliac bifurcation in 1711 participants, the bifurcation position was determined using CT by measuring Aorto-Iliac Bifurcation Distance (AIBD).[12] The mean AIBD was found to be 26±15 mm and the mean age was 62±10 years. The present study showed similar results with Forbang NI et al., study with the mean distance of 27.96±0.63 mm and mean age of 56.5±8 years. Also, in Lee CH et al., and Voboril R et

al., study, the results of the common site of aortic bifurcation was at L4 vertebra which was same as present study.[13,14] Major limitations of this study was large number of patients could not be included. We measured patient's parameter manually and the value may not be consistent. We measured the parameters of different patients so the level of the site of measurement might not be the same in all cases. Due to less time period, the number of female patients in BMI group >30 and also number of patients in age group >80 years was quite less. This type of study should be done in larger number of normal adult population to make the study more reliable.

Conclusion

In this study using CT, we found that as the age increased, APT distance decreased and there was no significant change in relation to BMI. Therefore, during sacral colpopexy, the surgeon should be careful and consider the aorta sacral promontory distance in the elder female patients while performing dissection.

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