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Original Research Article

Study Of Distance And Angle Between The Aorta And Superior Mesenteric Artery On Computerised Tomography Scan For Calculating Normal Values In Different Body Mass Index Categories And Sex In Indian Population

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Abstract: The objectives are to calculate values of distance between the aorta and superior mesentric artery (SMA) for body mass index of Indian population, to calculate normal distance between the aorta and SMA in different Body mass index categories in Indian population, to calculate the angles between the aorta and superior mesenteric artery in different sexes of Indian population and to establish normal values of angle between aorta and superior mesenteric artery in different sex categories in Indian population. A total of 300 patients were studied at our institute. Any patient undergoing Contrast enhanced CT abdomen scan and fulfilling criteria as described below- Patients of any gender with age more than 20 years. Normal serum creatinine values. Non allergic to iodinated contrast media. Patients refusing consent to study, having previous interventional surgery or history of duodenal obstruction was excluded from study. We studied 300 patients in four different BMI category groups for each sex. Mean values obtained from data of our study are different in all four BMI categories of same sex and different even in same BMI category of either sex. Overall mean values of both distance and angle between SMA and aorta were higher in males than females when compared for same BMI category group in Indian population. Knowledge of normal values of distance and angle between SMA and Aorta can help in diagnosis and may help in predicting patients at risk of developing SMA syndrome.
Keywords: Aorta, Superior Mesenteric Artery (SMA), Distance, Angle

INTRODUCTION

Duodenal obstruction is caused by various congenital and acquired conditions. One of the less common but interesting cause of obstruction of third part of duodenum which poses major difficulty in superior mesenteric artery syndrome (SMA syndrome).The superior mesenteric artery syndrome is a rare medical condition that describes the clinical symptoms resulting from vascular compression of the third part of duodenum in the angle between aorta and the superior mesenteric artery caused due to reduction of normal aorto mesentric distance and decline in the normal angle between superior mesenteric artery and abdominal aorta [1].

The superior mesenteric artery syndrome is a rare medical condition that describes the clinical symptoms resulting from vascular compression of the third part of the duodenum in the angle between the aorta and the superior mesenteric artery caused due to reduction of normal aortomesenteric distance and decline in the normal angle between superior mesenteric artery and abdominal aorta [2]. It has been termed by various names which mainly indicate the pathological mechanism of disease and includes aortomesenteric artery compression, arteriomesenteric duodenal compression [2], duodenal vascular compression [3], superior mesenteric artery [4], Willkie's [5] or cast syndrome [6]. It is often confused with mega duodenum creating more confusion in diagnosis. However SMA syndrome is clearly separate entity as compared to mega duodenum [7]. Mega duodenum is characterized by dilatation of the duodenum without primary or secondary duodenal stenosis which has been ascribed to intestinal myopathy and can be familial [8].

SMA syndrome was first described by the Austrian professor Carl Von Rotinaksy in his anatomy textbook in 1842 [9]. Since then, a number of case reports and reviews appeared and discussed the syndrome and its treatment. Subsequently, Wilkie published the first comprehensive series of 75 patients in 1927 ad his name become e common eponym for the superior mesenteric artery syndrome [10]. Although widespread case reports have been published in medical literature, most clinicians are still not aware of this disease and patients are often diagnosed only after a long history of abdominal complaints. This can be partly attributed to non specific clinical symptoms and signs besides less frequent occurrence [11].

Management strategies of SMA syndrome include medical approach to surgical correction of obstruction [12]. Different imaging tests have been used to diagnose SMA syndrome including barium study, fluoroscopy, Ultrasound, CT scan, MRI abdomen [14]. Use of multidetector technology and safer non ionic iodinated contrast media along with widespread availability of CT scanners, distance and angle between superior mesenteric artery and abdominal aorta can be studied which helps in prompt and confident diagnosis of SMA syndrome leading to improved clinical outcomes of patients [8, 9]. Surgical procedures include open duodeno jejunostomy, open gastrojejunostomy, strong operation, laproscopic technique of strong, laproscopic duodeno jejunostomy ([9, 13].

METHODS AND MATERIALS

300 patients were included in the study.

Inclusion criteria:

- Any patient undergoing Contrast enhanced CT abdomen scan and willing to participate in study and fulfilling criteria as described.
- Patients of any gender with age more than 20 years
- Normal serum creatinine values (0.7 – 1.4 mg %)
- Non allergic to iodinated contrast media.
- No prior history of gastrointestinal surgery or abdominal vascular interventions.

Exclusion criteria:

- Any patient refusing consent to the study.
- Any patient with duodenal obstruction including Willkie's syndrome.
- Patient who has undergone gastrointestinal surgery or abdominal vascular intervention.
- Patient with increased serum creatinine (> 1.4 mg %), allergic reactions to Iodinated contrast reactions.
- Patient in age group below 20 years, pregnant females.

Measurement of height and body weight was taken for each patient.

Body mass index was calculated susing:

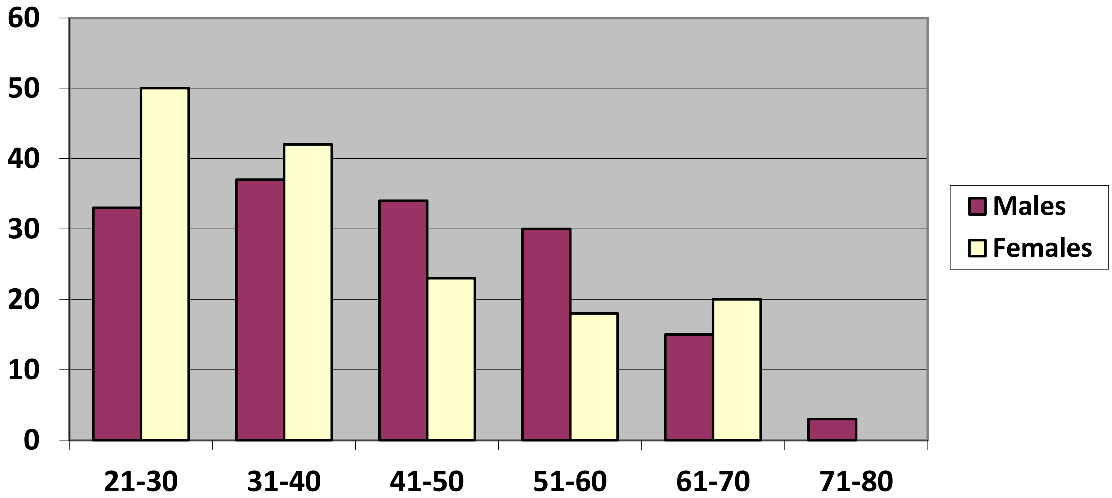
BMI = Mass (in kgs)/ Height (in m^2)

Patients were divided into four BMI categories for both genders –

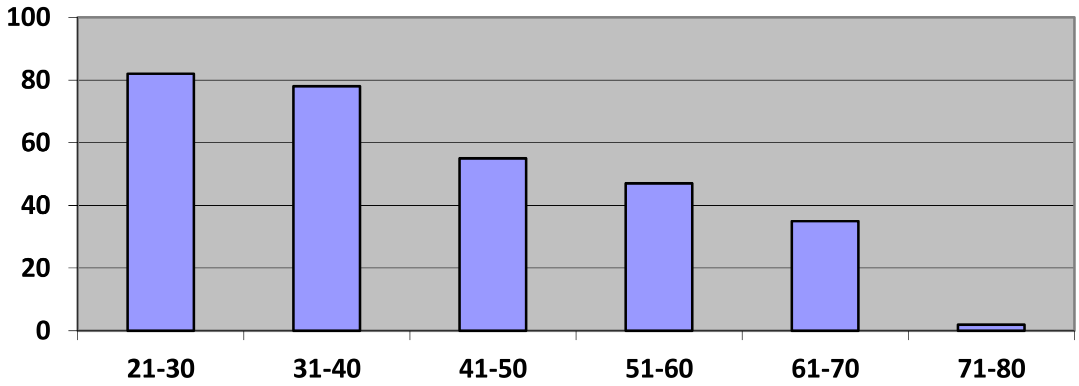
BMI CATEGORY	BMI RANGE
Category A	< 18.5
Category B	18.5 to 24.99
Category C	25 to 29.99
Category D	>30

Standard contrast enhanced abdomen scanning protocol included –
1. Plain phase
2. Arterial phase
3. Venous phase

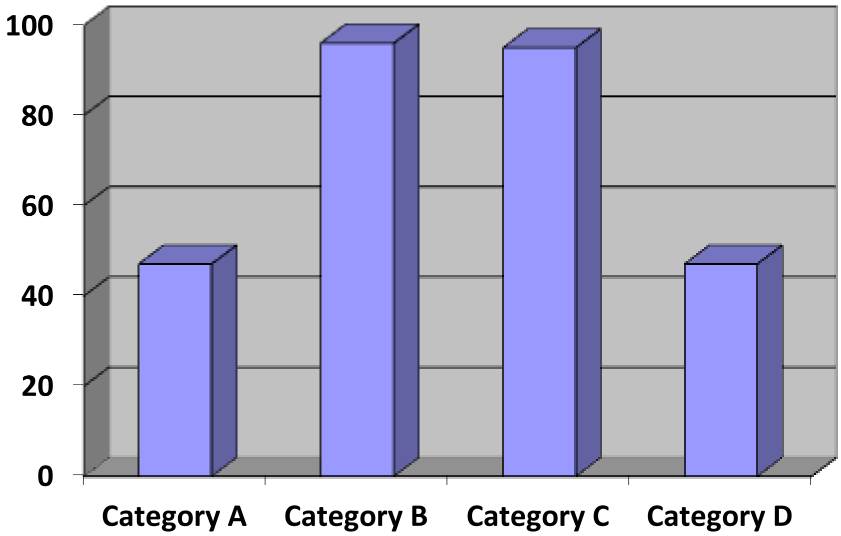
Plain scan was included from lung bases to pelvis. Followed by 1.5 ml/kg nonionic iodinated contrast material was injected at rate of 3ml/sec using pressure injector. Arterial phase scanning was included from lower thoracic aorta to abdominal aortic bifurcation. Venous phase scan was included from lung bases to pelvis. All the image data was sent electronically to a workstation for analysis. Only studies were included for data analysis which fulfilled above mentioned parameters and showed adequate opacification of arterial system of abdomen. Data for study was mainly obtained from arterial phase of contrast scan. From these images, sagittal or oblique-sagittal multiplanar reconstructed images were obtained for assessment of branching configuration of SMA from aorta. The distance between the SMA and aorta was measured as maximum distance between anterior margin of aorta and the posterior aspect of superior mesenteric artery at level where duodenum crosses on axial scans (Figure 1). Angle and distance between SMA and aorta was measured at origin of SMA on sagittal reformatted images (Figure 2).



Graph 1: Distribution of patients according to Age and sex



Graph 2: Distribution of patients in different age-groups



Graph 3: Patient distribution in different BMI categories

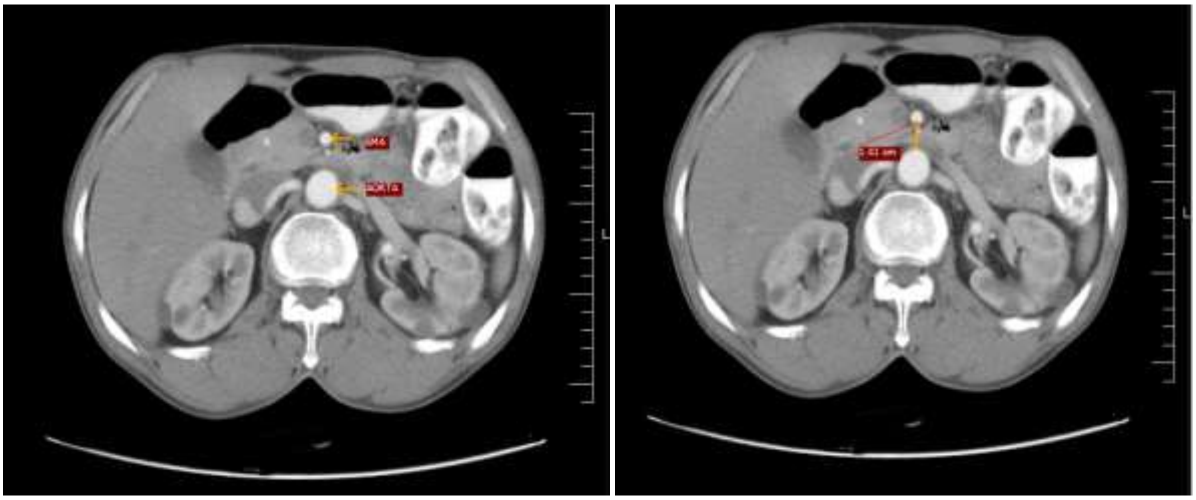


Fig 1: Axial CECT abdomen at the level of third part of Duodenum showing plane and method for measurement of distance between SMA and Aorta

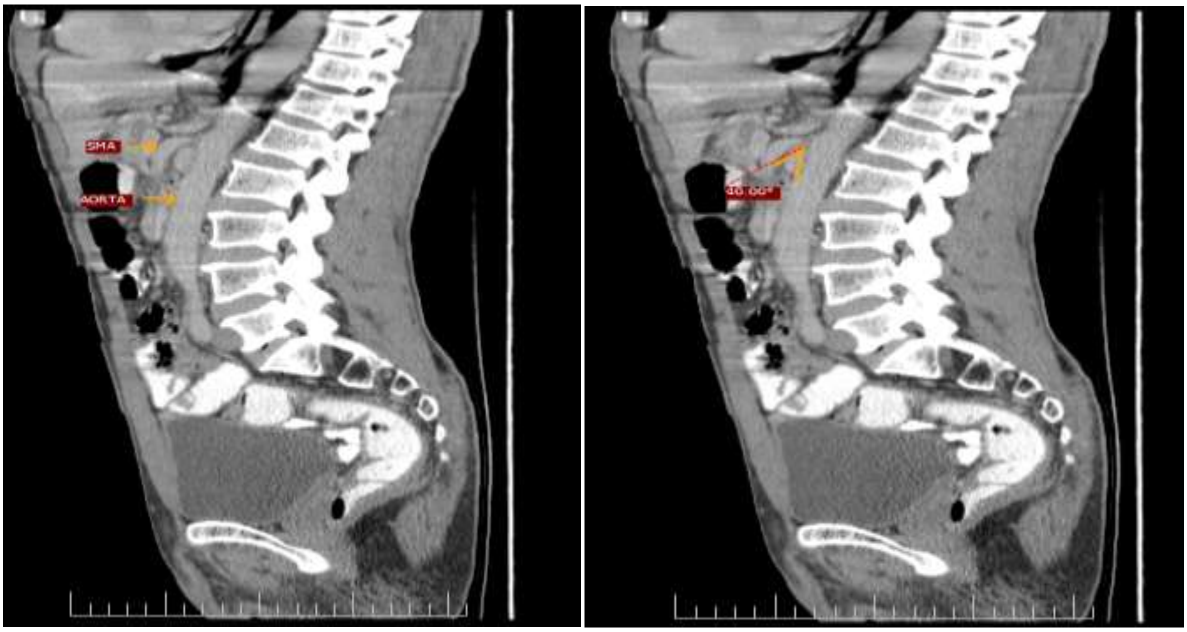


Fig 2: Sagittal section of CECT scans of Abdomen at the level of origin of SMA showing plane and method of measurement of angle

RESULTS

Study included 300 patients including 150 males and 150 females under four BMI category groups. Data obtained from study is analyzed for age distribution, sex distribution, BMI category distribution. Frequency distributions of distance and angle between SMA and aorta are calculated for each BMI category of both sexes (Table 2,4). Frequency distribution tables and charts are noted for each BMI category (Table 1,3). Anova test is used to study distance and angle for each BMI and sex category. Bonferroni post hoc test is used to study variables of study. Mean plots of distance and angle are calculated for each BMI category and sex of study population. Final values for Indian population are calculated considering standard error of mean.

Table 1: Distance between SMA and Aorta in different BMI categories in males.

	95% confidence interval of mean	
	Lower Bound	Upper Bound
Category A	8.7079	9.8841
Category B	11.7956	13.3084
Category C	15.1876	16.4524
Category D	18.3928	21.5832

Table 2: Angle between SMA and aorta in different BMI categories in males

	95% confidence interval of mean	
	Lower Bound	Upper Bound
Category A	25.426	33.294
Category B	48.145	55.855
Category C	64.164	71.676
Category D	74.19	89.25

Table 3: Distance between SMA and aorta in different BMI categories in females

	95% confidence interval of mean	
	Lower Bound	Upper Bound
Category A	8.0347	8.8613
Category B	9.8820	11.0060
Category C	11.7778	12.9582
Category D	18.7763	21.3117

Table 4: Angle between SMA and aorta in different BMI categories in females

	95% confidence interval of mean	
	Lower Bound	Upper Bound
Category A	22.0853	29.9947
Category B	37.9178	44.6422
Category C	53.1018	66.0982
Category D	69.1999	82.7201

DISCUSSION AND CONCLUSION

Superior Mesenteric Artery (SMA) syndrome is uncommon but potentially fatal cause of obstruction of third part of duodenum. Duodenal obstruction is caused due to reduction of normal aorto-mesenteric distance and angle between SMA and aorta. In absence of any specific clinical features diagnosis of SMA syndrome becomes a tough task. Due to high morbidity and mortality in patients with SMA syndrome. Imaging plays an important role for diagnosis of SMA syndrome. Contrast enhanced CT scan of abdomen reveals excellent anatomical and angiographical details helping to accurately determine values of distance and angle between SMA and Aorta. Out of all imaging modalities available for diagnosis of SMA syndrome, CT scans stands as current gold standard of diagnosis for SMA syndrome.

We studied 300 patients in four different BMI category groups for each sex. Men values obtained from data of our study are different in all four BMI categories of same sex and different even in same BMI category of either sex. Overall mean values of both distance and angle between SMA and aorta are higher in males than females when compared for same BMI category group in Indian population. The values of our study support previous studies indicting higher incidence of SM syndrome in females and debilitated patients. Knowledge of normal values of distance and angle between SMA and Aorta can help in diagnosis and may help in predicting patients at risk of developing SMA syndrome.

REFERENCES

1. Dietz UA, Debus ES, Heuko-Valiati L, Valiati W, Friesen A, Fuchs KH, Malafaia O, Thiede A. Das aortomesenteriale Kompressionssyndrom. Der Chirurg. 2000 Nov 1; 71(11):1345-51.
2. Ylinen P, Kinnunen J, Hockerstedt K. Superior mesenteric artery syndrome: a follow-up study of 16 operated patients. Journal of clinical gastroenterology. 1989 Aug 1; 11(4):386-91.
3. Roy A, Gisel JJ, Roy V, Bouras EP. Superior mesenteric artery (Wilkie's) syndrome as a result of cardiac cachexia. Journal of general internal medicine. 2005 Oct 1; 20(10):958-.
4. Lee CS, Mangla JC. Superior mesenteric artery compression syndrome. American Journal of Gastroenterology. 1978 Aug 1; 70(2).
5. Kwan E, Lau H, Lee F: Wilkie’s syndrome. Surgery 2004; 135:225-227.
6. Guthrie RH: Wilkie’s syndrome. Ann surgery 1971; 173;290-293.
7. Martin RJ, Khor TS, Vermeulen T, Hall J. Wilkie's syndrome may be due to poor motility. ANZ journal of surgery. 2005 Nov 1; 75(11):1027-.
8. Basilisco G. Hereditary megaduodenum. American Journal of Gastroenterology. 1997 Jan 1; 92(1).
9. Hines JR, Gore RM, Ballantyne GH. Superior mesenteric artery syndrome: diagnostic criteria and therapeutic approaches. The American journal of surgery. 1984 Nov 30; 148(5):630-2.
10. Wilkie’s DPD: Chronic duodenal ileus. Am J Med Sci 1927;173: 643-649
11. Welsch T, Büchler MW, Kienle P. Recalling superior mesenteric artery syndrome. Digestive surgery. 2007 Apr 27; 24(3):149-56.
12. McCue JD, Nath DS, Bennett BA: Image of the month. Superior mesentric artery syndrome. Australas Radiology. 2006; 141:607-608.

13. Little AF, Lavoipierre AM. Unusual clinical manifestations of the Nutcracker Syndrome. Journal of Medical Imaging and Radiation Oncology. 2002 Jun 1; 46(2):197-200.
14. Welsch T, Büchler MW, Kienle P. Recalling superior mesenteric artery syndrome. Digestive surgery. 2007 Apr 27; 24(3):149-56.