

A STUDY OF GALLBLADDER MEASUREMENTS AND ITS RELATION WITH VARIOUS ASSOCIATED FACTORS IN WESTERN U.P. POPULATION: A CROSS SECTIONAL STUDY

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Abstract

Background: Size of Gall bladder lumen and Common bile duct (CBD) has been found associated with various hepatic blockage and cholelithiasis. Variation in size of gallbladder lumen and length of CBD has been recorded which may have predictive values for diverse upcoming diseases in normal healthy subjects. The present study was designed to assess if there is any relation between the lumen of gallbladder and CBD with various anthropometric measurements and age. **Materials and Methods:** This study was conducted in the department of Anatomy, Venkateshwara Institute of Medical Sciences, Gajraula (U.P.). The present cross-sectional study included 102 normal individuals (50 male and 52 female) of age group from 18 to 60 years both sex. Volume of gallbladder was recorded with the sum of cylinders method. The width of CBD was measured from the proximal part of CBD. **Result:** Mean common bile duct diameter 3.62 ± 1.59 mm and mean gallbladder volume 19.93 ± 10.59 ml were recorded. There was a significantly greater gall bladder volume (4.7555 ± 1.5007) at 95% confidence interval in group I male subjects compare to group II female subjects with p value > 0.05 . There was approximately 6:1 ratio of gallbladder volume and common bile duct in group I male subjects. **Conclusion:** These findings observed in the current study might be useful in diagnosis of various threats for the liver disorders. Further, it should be helpful in prognosis of different liver and pancreatic diseases.

INTRODUCTION

Size of Gall bladder lumen and Common bile duct (CBD) has been found associated with various hepatic blockage and cholelithiasis.^[1]

Gallbladder and CBD is prone to obstructions and cholelithiasis in individuals due to different physiological and pathological reasons.^[2]

Variation in size of gallbladder lumen and length of CBD has been recorded which may have predictive values for diverse upcoming diseases in normal healthy subjects.^[1,3]

Measurement of gallbladder is one of the important and utmost component for prompt evaluation of biliary system.^[4] Size and different measurements of biliary tree plays an important role in obstructive and non-obstructive jaundice.^[5]

Length and width of CBD varies person to person from upper limit to lower limit still have an unclear

relation with various anthropometric parameters like height, weight and BMI.^[6]

Studies have recorded variation in CBD according to different anthropometric parameters in different races.^[4,7]

Sonography an old imaging technique is widely available now days in India even in remote areas in comparison to more effective, improved, advanced, less economical and rare available recent techniques like CT scan and MRI.^[7]

Sonography an old imaging technique in compare to more effective and improved recent techniques like CT scan and MRI is widely available now a day in India even in remote areas.^[8]

Sonography is equally effective and commonly used in medical practice for the diagnosis and prognosis of various hepatic and other disorders.^[9]

The present study was designed to assess if there is any relation between the lumen of gallbladder and

CBD with various anthropometric measurements and age.

MATERIALS AND METHODS

This study was conducted in the department of Anatomy, Venkateshwara Institute of Medical Sciences, Gajraula (U.P.).

The present cross sectional study included 102 normal individuals (50 male and 52 female) of age group from 18 to 60 years both sex. All the participants were narrated in detail the purposes of the study and asked to fill the Inform consent forms before participating in the study. The ethical committee of VIMS, Gajraula, approved the study.

Study population was divided in to two groups; group I included male subjects while group II consisted female participants. Present study included all the healthy individual of 18 to 60 years age group. All the subjects having chronic diseases or hepatic disorders, any disability and on medications or hormonal replacement therapy were excluded from the study. All the participants of the study were asked to come empty stomach in the morning before 9am for the sonography.

Ultrasonography

All the ultrasonographic images were recorded by 2D siemens ultrasound machine manufactured by Siemens Medical Solutions USA.

First of all subjects were scrutinized for any disease or disorder of gallbladder or CBD. Volume of gallbladder was recorded with the sum of cylinders method. Formula to calculate gallbladder volume = $1/6 \pi LBD^{10}$ Where L = maximum length, B = maximum width, D = maximum depth. The width of CBD was measured from the proximal part of CBD.

¹¹ All the measured parameters were followed before the sonography imaging of all the individuals.

Anthropometric Parameters

All the parameters height and weight were measured before the study. BMI was calculated by using the standard BMI calculation formula. ¹²

Statistical Analysis

All the sonographic measurements were expressed as Mean \pm SD (Standard deviation). To evaluate statistical significance of data between two groups unpaired students t-test was used. Pearson correlation \pm coefficient was used to assess if there is any correlation between different variables. A p-value $<$ 0.05 was considered statistically significant. IBM SPSS Statistics 21.0 manufactured by IBM USA was used for entire calculations.

RESULTS

All the results were expressed as mean \pm SD. There was an insignificant difference between the age of male and female subjects of both group (36.38 ± 12.12 vs 34.65 ± 14.31 , $p > 0.5133$).

The average age of total study population (one hundred two subjects) were 35.5 ± 13.24 years. The average height, weight and BMI of whole study population were 158.56 ± 8.95 cm, 56.41 ± 6.91 kg, 22.33 ± 1.8 kg/m² correspondingly. Further, mean common bile duct diameter 3.62 ± 1.59 mm and mean gallbladder volume 19.93 ± 10.59 ml were recorded.

Table 1 shows that there was increase in width of CBD as well as gallbladder volume according to increase of age in each age group.

[Figure 1] manifested a positive correlation between basal metabolism index and gallbladder volume in male subjects. The value of R was 0.2684 while R² value was 0.72.

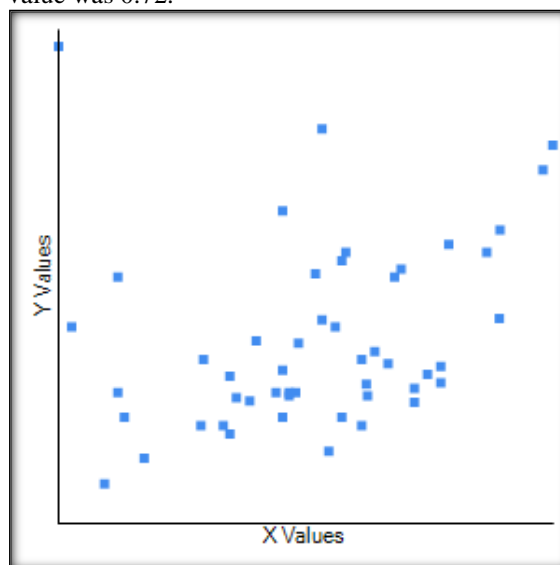


Figure 1: BMI (X values kg/m²) & GBV (Y values ml) correlation in male subjects.

[Figure 2] depicted that there was a positive correlation between basal metabolism index and common bile duct size in male subjects with R value 0.337. While R² value was 0.116.

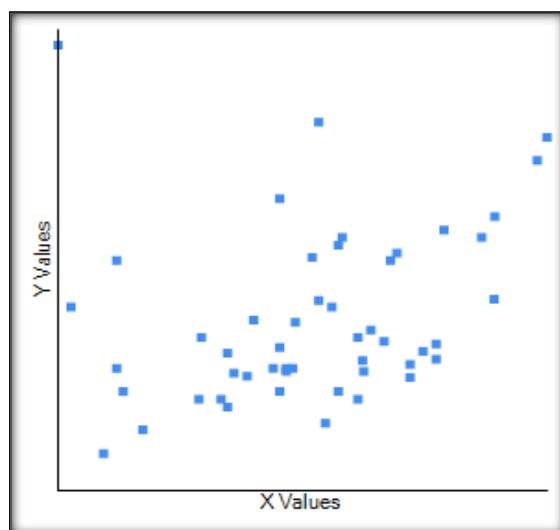


Figure 2: BMI (X values kg/m²) & CBD (Y values mm) correlation in male subjects

[Figure 3] represented a positive correlation between basal metabolism index and gallbladder volume in male subjects. The value of R was 0.5683 while R² value was 0.323.

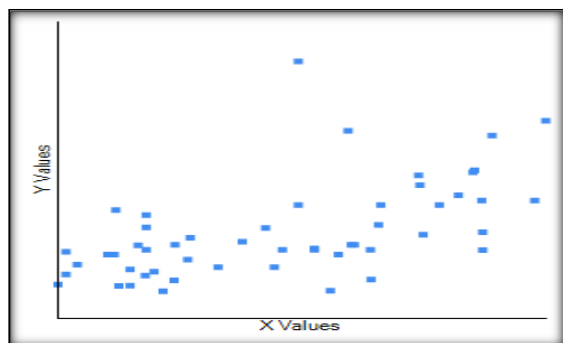


Figure 3: BMI (X values kg/m²) & GBV (Y values ml) in female subjects.

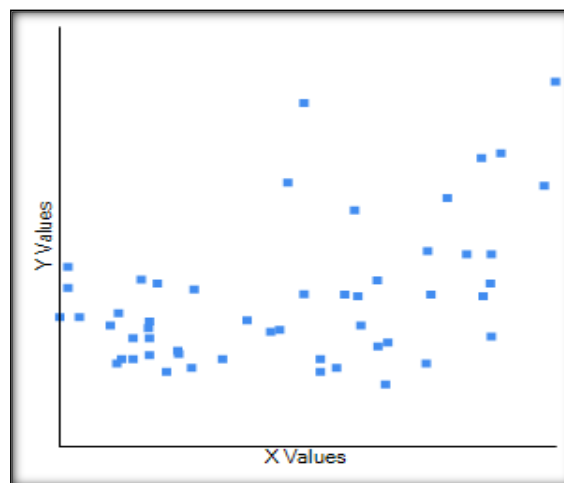


Figure 4: BMI (X values kg/m²) & CBD (Y values mm) correlation in female subjects.

[Figure 4] depicted that there was a positive correlation between basal metabolism index and common bile duct size in male subjects with R value 0.4695. While R² value was 0.2204.

Table 1: Distribution of CBD and Gallbladder volume according to age groups

Age group	CBD diameter (mm)	Range	Gallbladder volume (ml)	Range
15 – 30 years	2.7 ± 0.74	1.5 - 4.5	15.66 ± 7.17	5.6 - 48
31 – 45 years	3.890357 ± 1.53	1.9 – 8.7	20.16286 ± 9.03	7.8 - 40
46 – 60 years	4.547742 ± 1.82	2 – 8.2	25.335 ± 13.1	4.95 - 58

Table 2: Comparison of gallbladder volume and common bile duct size in both groups

Parameters	Group One Male	Group Two Female	t value	p value
Gallbladder Volume (ml)	22.3576 ± 11.1136	17.6021 ± 9.6129	2.3141	0.0227
Common bile duct size (mm)	3.692 ± 1.5233	3.556 ± 1.6783	0.4269	0.6703

Table 3: Ratio of gallbladder volume and common bile duct in both groups

Parameters	Group One Male	Group Two Female
GBL : CBD	22.3576: 3.692 = 6.06:1	17.6:3.55 = 4.95:1

[Table 2] shows that there was a significantly greater gall bladder volume (4.7555±1.5007) at 95% confidence interval in group I male subjects compare to group II female subjects with p value > 0.05.

Further, an insignificant difference at 95% confidence interval was observed between the sizes of common bile duct of both groups (p value < 0.05).

The range of gallbladder volume was 4.95 – 58 ml in group I male and 6.95 – 40 ml in group II female subjects. Whereas, the range CBD was 1.8 – 8.2 mm and 1.5 – 8.2 mm respectively for group I male and group II female subjects.

It has been evident from [Table 3] that there was approximately 6:1 ratio of gallbladder volume and common bile duct in group I male subjects. Whereas, group II female subjects showed a 5:1 ratio for gallbladder volume and common bile duct.

DISCUSSION

Studies have recorded increase size of width of gallbladder in liver diseases; moreover, a further increased size of gallbladder width is observed in pancreatic diseases.^[6]

Current study recorded the size of mean gallbladder volume 19.93 mm which is consistent with the results of previous studies of Ugwu AC et al,^[13] and Adeyekan A et al,^[14] as they observed gallbladder volume less than 24mm in their studies.

The width of the CBD was 3.62 mm in the present study which is very similar to the findings of Kaude JV et al,^[6] as they recorded the average 3.4 mm width of CBD in healthy population. Similarly, the Size of the CBD as recorded in the current study is very much alike to the previous study of Kariuki BN et al,^[15] Zuleta MAG et al,^[4] and Lal N et al.^[11]

Results of the present study revealed that gallbladder volume was increased with the advancement of age. These findings are similar to the findings of earlier studies of Kariuki BN et al,^[14]

as they recorded gallbladder volume was more in geriatric population compare to young population. Similarly, Bachar GN et al,^[16] and Govindan et al,^[17] observed that there was a gradual increase in gallbladder volume with advancement of age in their study population.

The incidence of cholelithiasis increases out of the way up to 10 times in population above 50 years.^[15] Commonly CBD width increases with age and found higher in old age subjects compare to younger population.^[15-17] This increase of width of CBD might be due to dilation of duct gradually as Bachar GN et al,^[16] observed in their study the effect of age on bile duct that it progressively dilate 0.04 mm/y. Similarly, Govindan et al,^[17] suggested that increase in CBD diameter with age is a physiological change. The incidence of cholelithiasis increases out of the way up to 10 times in population above 50 years.^[13] There is decrease in intensity of contraction with advancement of age which may increase the susceptibility of cholelithiasis due to prolonged stasis of bile.^[15,18] However, despite increase of gallbladder size with age there is no certain relation for generation of gallbladder stone and gallbladder size has been established.^[18]

The current study results proclaimed that the volume of CBD was greater in male comparison of female. These findings are alike the earlier studies Zuleta MAG et al,^[4] and Lal N et al,^[11] as they recorded greater size of gallbladder volume in male compare to female subjects.

This greater size gallbladder lumen in male might be due to higher BMI as size of gallbladder lumen is directly proportional to BMI.^[19] Higher the BMI greater the gallbladder volume more the stasis of bile increases the susceptibility for gallbladder diseases.^[15,19,20] High BMI is associated with increased risk of gallbladder diseases in both male and female.^[20]

It has been observed in present study that there was a positive Pearson correlation coefficient for BMI and CBD width for male as well as female subjects. Similarly, Daradkeh S et al,^[21] recorded a positive co-relation of BMI with CBD width.

A positive Pearson correlation coefficient for BMI and gallbladder lumen for both male and female subjects was recorded. Alike, Oluseyi KYH,^[22] observed a positive correlation between BMI and lumen of gallbladder.

CONCLUSION

These findings observed in the current study might be useful in diagnosis of various threats for the liver disorders. Further, it should be helpful in prognosis of different liver and pancreatic diseases. We need to work on a large population and additional markers to establish a more reliable and predictable model to evaluate the future disorders of biliary system with normal anatomical measurements.

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