Original article:

Body Mass Index – a predictor of Gall Stone Disease?

[1]Dr Ashok Kumar Das, [2]Dr Anku Moni Saikia, [3]Ms Anjana Moyee Saikia, [4]Dr Rupali Baruah

[1]Associate Professor, Dept of Surgery, FAA Medical College, Barpeta, Assam.

[2]Associate Professor, Dept. of Community Medicine, Gauhati Medical College, Guwahati, Assam.

[3]Statistician, Dept. of Community Medicine, Gauhati Medical College, Guwahati, Assam.

[4]Professor, Dept of Community medicine, Gauhati Medical College

Corresponding author: Dr Ashok Kumar Das

Abstract:

Introduction: Body Mass Index (BMI) has been identified as one of the predictors of Gall Bladder stone (GBS) Disease. However, its role is not found to be consistent. This preventable risk factor could easily be controlled with simple lifestyle changes. The present study was planned to assess the relationship between BMI and GBS over different age groups and gender.

Materials and methods: This hospital based case-control study was conducted in a tertiary care institution. Indoor case of Surgery Dept diagnosed to have GBS and after fulfilling the inclusion criteria were considered as cases. A total of 189 cases were taken for the study. Age and sex matched control at the ratio of 1:1 were taken as control. Family history of GBS disease were excluded from both cases and controls.BMI was measured and compared among cases and conthols. Chi square test and t test was used to see the difference.

Results and observations: Male female ratio was 3:1.Insignificant association was observed between mean BMI of cases and controls irrespective of gender. But when stratification was done based on gender, significant difference was seen in female.

Conclusion: BMI can be used as predictor of GBS only in case of female. Further studies are required to establish the link as predictor in both sexes.

Keywords: BMI, Obesity, Gall stone disease.

Introduction:

Obesity has been identified as one of the biggest risk factor of Gall Bladder Stone (GBS). It causes a rise in cholesterol by increasing hepatic cholesterol synthesis and hepatobiliary cholesterol efflux .It can also keep the gall bladder (GB) from emptying completely and cause bile stasis. Obesity combines with variables like age, sex and ethnicity greatly influence the prevalence and incidence of GBS. Body Mass Index (BMI) or Quetelet Index is a very reasonable indicator of body fat for both adults and children. Belgian Polymath Adolphe Queteret derived it 1832 from the mass (weight) and height of an individual. It was later termed as BMI in 1972 by Ancel Keys.BMI is being recognised by World Health Organization (WHO) as the standard for obesity statistic since the early 1980s.The system is simple, non-expensive and non-invasive. The cut-off point of BMI is 25kg/m^2 as per International Obesity Task Force for Asian and Pacific Island population which is lower than WHO [(1)]. Obesity, a preventable factor for GBS has not been studied in details especially in this part of the country. Hence, the present study has been undertaken to see the relationship between BMI and GBS.

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

Materials and methods:

This hospital based case control study was conducted in Fakhruddin Ali Ahmed Medical College Hospital (FAAMCH), in Barpeta District, Assam. The population in this area is mostly Muslim and tribal. Agriculture is the main source of income and majority belonged to Below Poverty Line (BPL).Cases were selected from indoor patients of Surgery Dept. Cases presented with acute upper abdominal pain with dyspeptic symptoms which were treated indoor at the hospital between Januarys -December 2014 were initially included in the study. A total of 474 such cases were screened for GBS. There was no clean cut diagnosis at the time of presentation. Ultrasonography (USG) was done routinely to all the patients. Informed consent was taken and those not willing to participate were excluded. Cases having history of GBS/ Cholecystectomy in the immediate family were also excluded. After the final diagnosis of GBS, 189 patients were found to fulfil the inclusion criteria, hence considered as cases. For every case, age and sex-matched control was taken from non-GBS group. Controls were also matched for family history of GBS/cholecystectomy.

Although ratio of total no of cases and controls were 1:1, in control group, matched control could not found for one case. Hence, there were 140 female and 49 male in the control group.Height and weight were recorded, and BMI, as a measure of overall obesity, was calculated as weight (kg)/height in square meter. Both cases and controls were considered as lean, normal build, pre-obese and obese when the BMI values were less than 18.5, 18.5-24.99 , more than or equal to 25 respectively.

Matching was not done for other variables.

Statistical analysis was done by using GraphPad InStat software. Results are expressed as the mean ± SD. Categorical differences were analysed using X^2 test. To see the difference between two means, t test was applied. P<.05 has been considered as significant.

Results and observations:

Table 1 : Relationship between mean BMI of cases and controls.

Subjects	Mean BMI±SD	t- Test	p value
Cases (n = 189)	23.3 ± 4.84	1.702	0.0895
Control (n = 189)	22.6 ± 2.92		

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

Table 2 : Gender wise distribution of mean BMI of cases and controls.

Gender	Mean BMI±SD	t- Test	p value
Male			
Cases	22.4 ± 3.25	0.857	0.394
Controls	21.9 ± 2.45		
Female			
Cases	23.6 ± 3.68	2.023	0.044
Controls	22.8 ± 2.90		

Table 3 : Distribution of cases and controls according to BMI and gender.

Subjects	BMI						χ^2	p value
Cases (n = 189)								
	< 18 yrs		18-24.9 yrs		≥ 25 yrs			
	(n)	%	(n)	%	(n)	%		
Female (n = 141)	45	31.9	61	43.3	35	24.8	6.563	0.0376
Male (n = 48)	9	18.8	31	64.6	8	16.6		
Total (n = 189)	54	28.6	92	48.7	43	22.7		
Controls (n = 189)								

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

Female (n = 140)	16	11.4	95	67.9	29	20.7		
Male (n = 49)	7	12.3	34	69.4	8	16.3	0.6129	0.7361
Total (n = 189)	23	12.1	129	68.3	37	19.6		

Table 4 : Distribution of GBS cases according to the gender, age group and BMI.

Gender	Age in years								χ^2	p value
Female	< 20 yrs		20-40 yrs		40 – 60 yrs		60 – 80 yrs			
	(n)	%	(n)	%	(n)	%	(n)	%		
BMI										
< 18	3	23.08	12	38.71	27	32.53	3	21.43		
18 – 24.9	7	53.58	7	22.58	38	45.78	9	64.29	9.592	0.1429
≥ 25	3	23.07	12	38.71	18	21.69	2	14.29		
Total	13	100	31	100	83	100	14	100		
Male										
BMI										
< 18	1	20	6	31.58	2	10	0			
18 – 24.9	4	80	11	57.89	14	70	2	50		
≥ 25	0	0	2	10.53	4	20	2	50	4.810	0.0290
Total	5	100	19	100	20	100	4	100		

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

Among the cases, age varied between 13 to 78 years. Majority (74.6%) were female and rest (25.4%) were male, ratio of 3:1.More than half (51.9%) belonged to BPL group. In Table 1 the mean BMI of cases and control were compared when both genders were considered together. An insignificant relationship was seen between mean BMI of cases versus control (Table 1). But when it was stratified according to gender, a significant difference was observed between mean BMI of cases and controls in females (p=0.044) whereas, mean BMI in male was not significant (p=0.394) among cases and controls, (Table 2).

In analysing the relationship of cases with BMI, age group and gender, it was seen that in females cases, 35 (24.8%) had BMI more than 25, in the remaining BMI is < 25.In case of male,16.6% had BMI more than 25. Again when total number of GBS cases is considered, 22.7% had BMI more than 25. This is found to be statistically significant (p=0.0376). The same relationship was insignificant in the control group (p=0.7361) (Table 3).

In analysing the relationship of cases with BMI, age group and gender, it was seen that among female cases, in < 20 years age group, 23% were found to be >25 BMI, another 23% had <18 BMI. Again in 20-40 years age group, equal percentage (38.71%) of female had <18 and >25 BMI. Similar trend was seen in other two age brackets. No statistical association was observed between these variables (p=0.1429). Among the male cases also, no relationship was seen between age and BMI (p=0.0290)(Table 4).

Discussion:

In this study, out of 474 cases enrolled, 51.9% belonged to BPL and 40% came out to be GBS. This is a remarkable observation and it implies that GBS is no more a disease of rich only.The old dictum of 'F' found to have relevance till today, as 74.6% of GBS cases were female in our study(female: male ::3:1). This was in conformity with other studies done worldwide including the famous Framingham study (3:1) [2].

BMI in female as a risk for GBS is obvious from the present finding. The significant association of mean BMI of cases and controls in female speaks for the evidence. The same was not significant when association of mean BMI were compared with total cases and controls irrespective of gender. This finding of relationship of BMI with female cases in the present study was in consistent with other studies [2-14]. A total of 5209 (2236 male +2873 female) people 30-62 years in Framingham USA were studied [2], where 427were positive for GBS. Female constituted 77.28% of all cases [2]. As relative weight increases (the ratio of subjects weight to median weight of all individuals of same sex and heights) from less than 0.9 to more than 1.02, the risk increased from 0.55to 1.25 in male and 0.85 to 1.77 in female.BMI was found to be increased in women, but only a trend in men [3] . Another large study by Manson Je and his co-worker [4] , among 90302 women clearly related BMI to GBS, the rise was in monotonic fashion from 0.28 /100 persons/year at BMI less than 24, to around 1/100 persons/year with BMI in the range of 30-45, and more than 2/100/year in BMI more than 45.In a study of obese women, [5] where the mean sample BMI was 31.4 ± 3.6 had cumulative incidence of GBS at 2.6 cases/100 women/year. BMI as risk factor for GBS irrespective of ethnicity have been observed among Hispanics [6], Mexicans [7]. Koreans [8]. Similar observation was also revealed in other studies. [9-14].

BMI was not a predictor when both sexes were considered together, but was a significant risk factor for women .This findings of the present study tallies to that of a south Indian study by Jayanti V and co-workers [15]. However, mean BMI

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

in the present was found to be relatively low as observed in other study [15]. This could be due to the socio-economic condition of the people in the study area. Contrary to this, Gupta and his c-workers[16] found high incidence of GBS in non-obese young females. Insignificant relationship of mean BMI among male cases and controls could be explained on the ground that BMI may not be as good an indicator of obesity in men as in women[3] due to various reasons. This is in conformity with a study done among Japanese men where BMI was not found to be associated with GBS although it was significantly positively related to Post cholecystectomy cases [17]. In contrary to the present finding of insignificant relationship of BMI in men, Kodoma and his co-workers reported that BMI, a marker of obesity is significantly associated with increased GBS disease [18].

The present finding of significant relationship of cases of GBS with Gender and BMI further substantiate the predictivity of risk of BMI. However, controls were not having significant relationship between gender and BMI. A positive association with present body mass index in women was revealed In a study done in a Danish population. Men also showed a non-significant trend towards higher prevalence among those with a body mass index above 30 [3].Similar finding was also reported in other studies [11],[15],[17].

While gender, age group and BMI were considered together among the cases, a insignificant association was seen. In a study done to see the relationship of GBS with some risk factors like age, sex, familiar history and obesity, familiar history was the only characteristic with a statistically significant positive relationship [18] .In the present study, as we have excluded the family history, the insignificant association could be due to some other uncontrolled biases and confounders.

The study has got few limitations. Few biases could not be avoided and some confounding factors were not controlled. Again, temporal association could not be derived considering the design of the study.

Conclusion:

BMI and as such obesity may be a predictor of GBS only in case of female. Further in depth longitudinal studies are required to see the strength of BMI as predictor of GBS in male .This preventable factor could be eliminated easily through simple lifestyle modification. There is high time for studying the validity of other measures for obesity.

References:

1. International Obesity Task Force. The Asia Pacific Perspective: redefining obesity and its treatment. Avaliable from: WWB.iotf.org/asiapacific feb 2010, page 17.

2. Friedman GD, Kannel WB, Dawber TR The epidemiology of gallbladder disease: Observations in the Framingham study. Journal of Chronic Diseases.1966; 19:273-92.

3. Jorgensen T. Gall stones in a Danish population. Relation to weight, physical activity, smoking, coffee consumption, and diabetes mellitus. *Gut* 1989; 30:528-534.

4. Stampfer MJ, Maclure KM,Colditz GA, Manson JE,Willett WC. Risk of symptomatic gallstones in women with severe obesity Am J Clin Nutr 1992 ;55 : 652-8.

5. Acalovschi MV, Blendea D, Pascu M, Georoceanu A, Badea RI, Prelipceanu M. Risk of asymptomatic and symptomatic gallstones in moderately obese women: a longitudinal follow-up study. The American Journal of Gastroenterology .1997, 92:127-31.

6. Samet JM, Coultas DB, Howard CA, Skipper BJ, . Hanis CL. Diabetes, Gallbladder Disease, Obesity, and Hypertension among Hispanics In New Mexico. Am. J. Epidemiol. 1988; 128:1302-11

7. Sanchez NM, Vega H, Uribe M, Guevara L, Ramos MH. Risk Factors for Gallstone Disease in Mexicans are Similar to Those Found in Mexican-Americans. Digestive Diseases and Sciences 1998; 43: 935-39

8. Chang YR, Jang JY, Kim SW. Chang YR, Changes in Demographic Features of Gallstone Disease: 30 Years of Surgically Treated Patients. *Gut Liver*. 2013; 7: 719-24.

9. Misciagna G, Centonze S, Leoci C, Guerra V, Cisternino AM ,Ceo R, et al. Diet, physical activity, and gallstones--a population-based, case-control study in southern Italy. Am J Clin Nutr 1999 69: 120-6.

10. Stender S, Nordestgaard BG, Tybjærg-Hansen A. Elevated body mass index as a causal risk factor for symptomatic gallstone disease: A Mendelian randomization study. Hepatology.2013 58: 2133–41

11. Selvaraju R, , Raman RG, Thiruppathi G, Valliappan R. Epidemiological Study of Gallstone in Cuddalore District. International Journal of PharmTech Research. 2010; 2: 1061-67.

12. Murshid KR. Symptomatic gallstones: a disease of young Saudi women.Saudi J Gastroenterol. 1998; 4: 159-62.

13. Sahi T, Paffenbarger RS,Hsieh CC,Lee IM. Body Mass Index, Cigarette Smoking, and Other Characteristics as Predictors of Self-Reported, Physician-Diagnosed Gallbladder Disease in Male College Alumni. Am J Epidemiol 1998.;147:, 644-51.

14. Hou L, Shu XO, Gao YT, Ji BT, Weiss JM, Yang G et al. Anthropometric measurements, physical activity, and the risk of symptomatic gallstone disease in Chinese women. Ann Epidemiol. 2009 ;19:344-50.

15. Jayanthi V, Prasanthi R, Sivakaumar G, Surendran R, Srinivas U, Mathew S et al . Epidemiology of gallstone disease–top line findings. *Bombay Hosp Journal.1999;* 41: 494-502.

16. Gupta RL, Sharma SB, Kumar SP, Monika. Changing trends (clinico-biochemical) in gall-bladder stone disease--an observation. Indian J Med Sci. 1998; 52:309-16.

17. Kono S, Shinchi K, Todoroki I, Honjo S, Sakurai Y, Wakabayashi K, et al. Gallstone disease among Japanese men in relation to obesity, glucose intolerance, exercise, alcohol use, and smoking .Scand J Gastroenterol. 1995; 30: 372-6.

18.Kodoma H, Kono S, Todoroki I, Honjo S, Saukarai Y,Wakabayashi K, et al. Gallstone disease risk in relation to body mass index and waist-to-hip rato in Japanese men. Int J Obes Relat Metab Disord 1999;23:211-6.

18. Salinas G, Velásquez C, Saavedra L, Ramírez E, Angulo H, Tamayo JC et al. Prevalence and risk factors for gallstone disease. Surg Laparosc Endosc Percutan Tech. 2004; 14: 250-3.

19.Radmard AR,Merat S,Kooraki S,Ashrafi M,Keshtkar A,Sharafkhah M. Gallstone disease and obesity:A population-based study on abdominal fat distribution and gender differences. Annals of Hepatology.2015;14:702-9.