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Original Research Article

To Determine the Correlation between Cholelithiasis and Body Mass Index (BMI) and Waist-To-Hip Ratio

Sumit Mishra[1], Alok Ranjan[2], Chandra Mohan Sinha[3]

[1]Senior Resident, Department of General surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

[2]Senior Resident, Department of General surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

[3]Associate Professor, Department of General surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

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Corresponding Author: Dr. Alok Ranjan
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Abstract

Aim: To determine the correlation between cholelithiasis and body mass index (BMI) and waist-to-hip ratio.

Material and Methods: This research was done in the Department of General surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India for one year, on a sample of 100 individuals who presented with abdominal discomfort and met the specified inclusion criteria. The test group consisted of 50 individuals who were diagnosed with cholelithiasis, whereas the control group consisted of 50 patients who had abdominal discomfort due to causes other than cholelithiasis. The patients underwent investigations including complete blood count (CBC), liver function tests (LFT), renal function tests (RFT), and abdominal ultrasound (USG). The BMI was computed using the usual calculation known as Quetelet's index, which involves dividing the weight (in kilograms) by the square of the height (in meters). The Waist Hip ratio was assessed using the World Health Organization (WHO) methodology.

Results: The Cholelithiasis group had a mean Body Mass Index (BMI) of 28.85±1.28, with a median of 25.23. The least BMI observed was 18.55, while the greatest was 35.23. The group without cholelithiasis had an average BMI of 25.23±1.87, with a median of 23.88 (ranging from a low of 17.25 to a high of 32.33). Within the cholelithiasis group, 11 patients (22%) out of a total of 50 had a BMI within the normal range, whereas 39 patients (78%) had a BMI beyond the normal range. Waist hip ratio was matched between the two groups and was found to be significant ($p<0.05$) (Table 5). cholelithiasis group had a mean WHR of 1.13±0.02 with a median of 0.8 (minimum=0.7 and maximum=1.2). Non cholelithiasis group had a mean of 1.22±0.03 with a median of 0.7 (minimum=0.6, maximum age=1.2) In cholelithiasis group, 3(6%) patients out of 50 were found to be within normal WHR limit, whereas 47 patients (94%) were within higher WHR limits. In non-cholelithiasis group, 10 patients (20%) out of 50 were found to be within normal WHR limits, whereas 40 patients (80%) were within higher WHR limits.

Conclusion: Our findings indicate that there is a correlation between being female, being obese, and having a higher chance of developing cholelithiasis.

Keywords: Cholelithiasis, Body mass index, Waist to hip ratio

Introduction

Cholelithiasis, sometimes referred to as gallstone disease, is a common gastrointestinal ailment characterized by the development of stones in the gallbladder. The composition of these stones is mostly comprised of cholesterol, bilirubin, and calcium salts. Cholelithiasis, a condition characterized by the presence of gallstones, impacts about 10-15% of adults in industrialized nations. This condition may result in serious health issues such cholecystitis, pancreatitis, and biliary blockage, leading to substantial morbidity and healthcare expenses. [1,2]

The cause of cholelithiasis is complex, including contributions from genetic, metabolic, and environmental variables. Of them, obesity and the way body fat is distributed have been recognized as important variables that increase the risk of certain conditions. Multiple studies have shown a robust association between body mass index (BMI) and the occurrence of gallstone disease. Elevated BMI is

linked to heightened production and release of cholesterol into bile, which encourages the creation of excessively concentrated substances and subsequent development of stones. [3,4]

Furthermore, the way body fat is distributed, specifically the measurement of central adiposity using waist-to-hip ratio (WHR), has been linked to the development of cholelithiasis. Central obesity is linked to insulin resistance and metabolic syndrome, which increase the production of cholesterol in the liver and hinder the synthesis of bile acids, hence promoting the development of gallstones. Research has shown that persons who possess a larger waist-to-hip ratio (WHR) are at an increased likelihood of getting gallstones in comparison to those who have a more distributed fat pattern in the periphery. [5-8]

With the increasing occurrence of obesity worldwide, it is essential to comprehend the connection between body mass index, waist-to-hip ratio, and cholelithiasis in order to create preventative measures and enhance therapeutic results. The objective of this research is to examine the relationship between BMI, WHR, and the prevalence of cholelithiasis in a group of patients. This will help identify possible risk factors and contribute to the development of public health interventions.

Material and Methods

This research was done Department of General surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India for one year, on a sample of 100 individuals who presented with abdominal discomfort and met the specified inclusion criteria.

Written consents were obtained from all patients participating in the trial after providing them with relevant information. All patients, regardless of gender, who were over the age of 20 and willing to participate, were included in the research if they had abdominal discomfort. The research excluded patients with comorbid illnesses such as cardiac disease, renal failure, ascites, and hypoproteinemia. Additionally, patients who were not willing to participate in the trial, pregnant women with gallstones, patients with any abdominal mass and gallstone, and patients with a history of prior surgery were also eliminated.

A comprehensive medical history was meticulously obtained, with specific focus on the hepato-biliary system and identification of potential risk factors. Every patient had a physical examination to evaluate their overall health and get essential crucial information upon admission. An abdominal examination was conducted following the normal methodology, and the observations were recorded.

The test group consisted of 50 individuals who were diagnosed with cholelithiasis, whereas the control group consisted of 50 patients who had abdominal discomfort due to causes other than cholelithiasis.

The patients underwent investigations including complete blood count (CBC), liver function tests (LFT), renal function tests (RFT), and abdominal ultrasound (USG). The BMI was computed using the usual calculation known as Quetelet's index, which involves dividing the weight (in kilograms) by the square of the height (in meters).

The Waist Hip ratio was assessed using the World Health Organization (WHO) methodology. This included measuring the waist at the midway between the lower edge of the last palpable rib and the top of the iliac crest, using a standard measuring tape. The hip circumference is measured by wrapping a tape measure around the broadest part of the buttocks, keeping it parallel to the floor. The measurements were obtained at the last stage of a typical exhalation.

According to the World Health Organization (WHO), abdominal obesity is characterized by a waist hip ratio over 0.9 in men and above 0.85 in females, or a body mass index (BMI) more than 30 kg/m2. Patients were evaluated for therapy based on the severity of their symptoms and indicators, as well as the results of their ultrasonography.

Statistical Analyses

Statistical analyses will be conducted using unpaired t-tests or Mann-Whitney tests for continuous variables, and chi-square tests or Fisher's exact tests for categorical variables. A significance level of $p<0.05$ was used to determine statistical significance. The statistical software SPSS version 25 was used.

Results

The age distribution was compared and found to be similar between the group with cholelithiasis and the group without cholelithiasis (p value > 0.05). (Table.1) The age of the patients varied from 22 to 76 years, with the majority falling between the ages of 40 and 50 (53%). The Cholelithiasis group had a mean age of 46.52 ±9.85 years, with a median age of 47 years. The minimum age in this group was 23 years, while the maximum age was 75 years. The Non Cholelithiasis group had an average age of 47.41 ± 12.20 years, with a median age of 43.5 years.

The gender distribution was compared and found to be statistically significant between the group with cholelithiasis and the group without cholelithiasis ($p<0.05$) (Table 2). The cholelithiasis group consisted of 33 females (62%) and 17 men (34%), while the non-cholelithiasis group included 19 females (38%) and 31 males (62%). The findings showed a considerably greater prevalence of

cholelithiasis in females compared to the other group.

Among the entire sample size of 100, exactly 50 patients (50.00%) were diagnosed with cholelithiasis. The control group consisted of individuals who had different causes of abdominal discomfort, such as acute gastritis, GERD, diverticulitis, renal calculi, and so on.

Table 1: Age distribution.

Parameter	Final diagnosis				Total	%	P value
	Cholelithiasis	%	Non cholelithiasis	%			
Age (in years)							
Below 30	6	12	7	14	13	13	0.26
30-40	1	2	3	6	4	4	
40-50	29	58	24	48	53	53	
50-60	10	20	9	18	19	19	
60-70	3	6	6	12	9	9	
Above 70	1	2	1	2	2	2	
Total	50	100	50	100	100	100	

Table 2: Gender distribution.

Gender	Cholelithiasis	%	Non-cholelithiasis	%	Total	%	P value
Female	33	66	19	38	52	52	<0.001
Male	17	34	31	62	48	48	
Total	50	100	50	100	100	100	

Table 3: Final diagnosis.

Variable	Frequency	%
Acute gastritis	5	10
Cholelithiasis	26	52
Diverticulitis	1	2
GERD	8	16
Pyelonephritis	2	4
Renal calculi	3	6
Ureteric calculus	2	4
UTI	3	6
Total	50	100

Table 4: BMI distribution.

BMI (kg/m^2)	Cholelithiasis	%	Non-cholelithiasis	%	Total	%	P value
18.50-24.99	11	22	27	54	38	38	<0.001
25-29.99	32	64	20	40	52	52	
>30	7	14	3	6	10	10	
Total	50	100	50	100	100	100	

Table 5: Waist hip ratio distribution.

Variables	Final diagnosis				Total	%	P value
	Cholelithiasis	%	Non-cholelithiasis	%			
WHR distribution							
Below normal	0	0	0	0	0	0	0.04
Normal	3	6	10	20	13	13	
Abnormal	47	94	40	80	87	87	
Total	50	100	50	100	100	100	

Table 6: Weight distribution.

Weight distribution	Cholelithiasis (%)		Non-cholelithiasis (%)		Total (%)		P value
Below normal	0	0	0	0	0	0	<0.001
Normal	2	4	9	18	11	11	
Abnormal	48	96	41	92	89	89	
Total	50	100	50	100	100	100	

The BMI of the two groups was compared and found to have a significant difference ($p<0.05$) (Table 4). The Cholelithiasis group had a mean Body Mass Index (BMI) of 28.85±1.28, with a median of 25.23. The least BMI observed was 18.55, while the greatest was 35.23. The group without cholelithiasis had an average BMI of 25.23±1.87, with a median of 23.88 (ranging from a low of 17.25 to a high of 32.33). Within the cholelithiasis group, 11 patients (22%) out of a total of 50 had a BMI within the normal range, whereas 39 patients (78%) had a BMI beyond the normal range. Among the 39 patients, 32 were into the pre-obese range whereas 7 were classified as being in obesity class 1. Among the non-cholelithiasis group, 27 out of 50 patients (54%) had a BMI within the normal range, whereas 23 patients (46%) had a BMI beyond the normal range. Among the 23 patients, 20 individuals were into the pre-obese range, whereas only 3 patients met the criteria for obesity class 1. The findings of our research were statistically significant, indicating that there is a causal link between greater BMI and the development of cholelithiasis.

Waist hip ratio was matched between the two groups and was found to be significant ($p<0.05$) (Table 5). cholelithiasis group had a mean WHR of 1.13±0.02 with a median of 0.8 (minimum=0.7 and maximum=1.2). Non cholelithiasis group had a mean of 1.22±0.03 with a median of 0.7 (minimum=0.6, maximum age=1.2) In cholelithiasis group, 3(6%) patients out of 50 were found to be within normal WHR limit, whereas 47 patients (94%) were within higher WHR limits. In non-cholelithiasis group, 10 patients (20%) out of 50 were found to be within normal WHR limits, whereas 40 patients (80%) were within higher WHR limits. The results of our study were significant, thus depicting that higher WHR has a causal relationship with development of cholelithiasis.

Discussion

The research comprised a cohort of 100 individuals who came with stomach discomfort. The participants were classified into control and test groups. The test group consisted of 50 individuals who were diagnosed with cholelithiasis, whereas the control group consisted of 50 patients who had abdominal discomfort due to causes other than cholelithiasis. The patients included in our research were between the ages of 22 and 76 years in the cholelithiasis group, with an average age of 46.52 ± 9.85 years. In the non-cholelithiasis group, the patients were between the ages of 21 and 75 years, with an average age of 47.41 ± 12.20 years. The highest occurrence of cholelithiasis was seen in individuals aged between 40 and 50 years, accounting for 58% of cases. Similarly, the non-cholelithiasis group also had the highest prevalence in the same age range, with 48% of cases. The average age of patients with cholelithiasis was similar to that of patients in the non-cholelithiasis group, and this difference was not statistically significant (p value=0.26). The age distributions in our research are similar across both groups. The findings of our study are similar to those of the research done by Shabanzadeh et al in 2016, which reported an average age of 50 years for the development of gallstones. [9]

In our research, the cholelithiasis group had a higher number of female patients (n=33) compared to male patients (n=17), whereas the non-cholelithiasis group had a higher number of male patients (n=31) compared to female patients (n=19). The gender distribution differed significantly between the group with cholelithiasis and the group without cholelithiasis ($p<0.001$). Therefore, our research findings indicate that the occurrence of gallstone disease is more prevalent in females than in men. The role of gender as a risk factor for cholelithiasis is still a subject of debate. investigations done in Western countries have generally shown that women are more prone to developing cholelithiasis (gallstones) compared to males, as determined by Tazuma, Volzke et al. However, investigations conducted among Asian patients have not found any significant difference in the occurrence of cholelithiasis between genders. [10-13]. Liu et al. discovered that the occurrence of cholelithiasis is more common in males under the age of 50, whereas it is more prevalent in women over the age of 50. [14] The prevalence of cholelithiasis in females in our research aligns with the findings of Tazuma and Volzke et al. [10,11]

The BMI of the two groups was compared and a statistically significant difference was seen ($p<0.05$). The Cholelithiasis group had an average BMI of 28.85±1.28, whereas the non-cholelithiasis

group had an average BMI of 25.23±1.87. Among the group of patients with cholelithiasis, 39 individuals (78%) had a BMI that exceeded the recommended limits. Among the 39 patients, 32 were into the pre-obese range, whereas 7 patients (14%) were classified as being in obesity class 1. Among the patients who did not have cholelithiasis, 23 individuals (46%) had a BMI that exceeded the recommended limits. Among the total of 23 patients, 20 patients were categorized as pre-obese, while just 3 patients fell into the obesity class 1 category. The findings of our research are statistically significant, indicating that there is a causal link between greater BMI and the development of cholelithiasis. Stender et colleagues used a Mendelian randomization methodology, selecting a total of 77,679 people, out of whom 4,106 individuals had symptomatic gallstone disease during a follow-up period of up to 34 years. The researchers determined that there is a direct relationship between a high body mass index (BMI) and an elevated likelihood of experiencing symptomatic gallstone disease. Our investigation revealed that the Body Mass Index (BMI) was increased in 79 individuals, accounting for 79% of the total. Therefore, our findings align with the research carried out by Stender et al. [15]

Waist hip ratio was matched between the two groups and was found to be significant ($p<0.05$). Cholelithiasis group had a mean WHR of 1.13±0.02 whereas non cholelithiasis group had a mean of 1.22±0.03. In cholelithiasis group 47 patients (94%) were within higher WHR limits, whereas in non-cholelithiasis group, 40 patients (80%) were within higher WHR limits. The results of our study were significant, thus depicting that higher WHR has a causal relationship with development of cholelithiasis. Tsai et colleagues performed a prospective research in 1986 in the US to investigate the association between abdominal obesity and gallstone disease. The waist to hip ratio was used as a metric to assess abdominal obesity. Among the 1117 patients diagnosed with gallstone disease, 866 of them were men who had a waist-to-hip ratio (WHR) greater than 0.9. The researchers determined that there is a significant correlation between abdominal obesity and gallstone disease. In addition, they said that waist-to-hip ratio (WHR) may be used as a standalone measure, apart from body mass index (BMI), to forecast the likelihood of developing gallstone disease. [16]

Conclusion

Our findings indicate that there is a correlation between being female, being obese, and having a higher chance of developing cholelithiasis.

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