

Original Research Article

Pattern of gallstone disease in an industrial township in India: are the risk factors different?

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ABSTRACT

Background: The prevalence of gallstones among different populations is varied, which reflects the role of genetic and environmental factors, besides common factors like age, sex, parity, obesity and diet. Being a commonly treated surgical problem, we attempted to study the epidemiology, risk factors and predisposing factors related to gallbladder disease in our setup- the industrial township of Bharat Heavy Electricals Limited (BHEL), Bhopal, India.

Methods: This was an observational study done over a period of 2 years. The patients were analyzed on the basis of age and sex distribution, dietary habits, body mass index, activity level, monthly income, family history, parity, associated illness if any, and abdominal ultrasound findings.

Results: Of 104 patients, 44 were males and 60 females, with female to male ratio being 1.36:1. The commonest age group to be affected was 61 to 70 years (35 patients, 33.65%). Better socioeconomic status, lower activity level, higher parity, vegetarian diet and consumption of plant-origin fats were the factors present in most patients. No family history was present in 97.11% patients.

Conclusions: As gallstones have multi-factorial etiology, it is difficult to disassociate their influence and to pin point towards the contribution of any one factor. But the results suggest that there is more than what meets the eye. Higher incidence in males and absence of family history point towards a cause not found in genes or at home, but something present in the workplace environment, where men form the major part of workforce.

Keywords: Cholelithiasis, Gallstone disease, Risk factors, Epidemiology, Industrial township, BHEL

INTRODUCTION

Gallstone disease is one of the most common problems affecting the digestive tract. At least 10% of the general population has gallstones.¹ Most patients remain asymptomatic throughout life, with approximately 1-2% of the asymptomatic individuals becoming symptomatic per year. Also, up to 30% of the patients who have one episode of pain do not have a later episode. The risk of development of biliary complications is estimated to be 1-2% per year, and remains relatively constant over time.² Although type of gallstone is not discriminatory,

its presence increases the risk of gallbladder malignancy by 7 times.³

The prevalence of gallstones is related to many factors like age, sex, parity, obesity, diet, etc. There is difference reported in prevalence among different populations, which reflects the role of genetic and environmental factors also. Gallstones are approximately two times more common in women than in men.¹ Women have a higher incidence than men at 30 and 40 years of age, but this difference disappears with increasing age.¹ A strong linear association has also been found between body mass

index and the reported incidence of gallstones.¹ Rapid weight loss is also a recognized risk factor for cholesterol gallstone formation.¹

A gross estimate of all gastrointestinal surgeries being done at our centre showed that cholecystectomy comprised as high as 30% of all the procedures. So, it was considered worthwhile to study the epidemiology, the risk factors and the predisposing factors related to the gallbladder disease in our setup i.e. the industrial township of Bharat Heavy Electricals Limited (BHEL), Bhopal.

METHODS

This was an observational study done at Kasturba Hospital, BHEL, Bhopal over a period of 2 years from December 2005 to November 2007. All patients with gallstones attending the outpatient department or emergency were included in the study. Patients who did not give consent were excluded from the study.

The patients were asked about dietary habits, activity level, monthly income, family history, parity and associated illness, if any. Abdominal ultrasound (USG) findings and body mass index (BMI) were noted. BMI was calculated as weight (in kilograms)/height² (in meters). The diagnosis of gallstone disease was made on USG.

An institutional ethical approval was obtained and informed consent was taken. The statistical analysis was done using MedCalc®. Data were expressed as percentages, mean and range.

RESULTS

A total of 104 patients were included in the study. Out of these, 44 patients were males (42.30%) and 60 patients were females (57.69%) with female to male ratio being 1.36:1. The commonest age group to be affected was 61 to 70 years (35 patients, 33.65%) followed closely by 51 to 60 years age group (34 patients, 32.69%). 9 (8.65%) patients, all women, were up to 40 years of age at presentation.

Only 8.65% patients had income below 15,000 Indian Rupees per months. Similarly, only 13 patients (12.5%) had an active lifestyle. Majority of patients (97.11%) had no family history of gallstones. 71 (68.26%) patients were vegetarian and 83 (79.80%) consumed fat from plant origin (Vanaspati). Only 12 patients consumed more than 50 grams of fat per day (Table 1).

Least incidence was seen in nulliparous women (6.67%) (Table 2).

Twenty eight patients had preexisting diabetes mellitus, while ischemic heart disease, hypertension, gastro-

esophageal reflux disease and renal calculus were also found to co-exist with gallstone disease (Table 3).

Table 1: Association with various factors.

Parameter		No. of patients (%)
Monthly income (Indian rupees per month)	<15,000	9 (8.65)
	15000- 50000	51 (49.03)
	>50,000	44 (42.30)
Activity level	Sedentary	17 (16.34)
	Mixed	74 (71.15)
	Active	13 (12.50)
BMI	<25	30 (28.84)
	25-29.9	48 (46.15)
	≥30	26 (25.01)
Family history of gall stones	Present	3 (2.89)
	Absent	101 (97.11)
Diet	Vegetarian	71 (68.26)
	Non vegetarian	33 (31.74)
Type of fat consumed	Plant origin	83 (79.80)
	Animal origin	21 (20.19)
Daily fat intake (grams per day)	<10	8 (7.69)
	11-25	39 (37.50)
	26-50	45 (43.27)
	> 50	12 (11.54)

Table 2: Distribution of women according to their parity.

Parity	No. of patients (%)
Nulliparous	4 (6.67)
1-3 children	32 (53.33)
4-5 children	16 (26.67)
6 or more children	8 (13.33)
Total	60 (100)

Table 3: Incidence of other diseases.

Disease	No. of patients (%)
Diabetes mellitus	28 (26.92)
Ischemic heart disease	18 (17.30)
Hypertension	12 (11.54)
Gastro-esophageal reflux disease	6 (5.77)
Renal calculus	1 (0.96)

Table 4: USG findings.

Findings	No. of patients (%)
Single stone	11 (10.57)
Two to three stones	13 (12.50)
Multiple stones	54 (51.92)
Biliary sludge	18 (17.3)
Cholelithiasis	4 (3.84)
Carcinoma gall bladder	4 (3.84)
Total	104 (100)

Majority of patients (54, 51.92%) had multiple stone and the incidence of carcinoma gall bladder was 3.84% in this patient population. Common bile duct stones were found in 4 (3.84%) patients of gallstone disease.

DISCUSSION

Gallstones are the most common biliary pathology, and cholecystectomy is one of the most common operations performed by general surgeons. Various causal factors have been studied in different populations, with results suggestive of definite correlations between gallstone formation and age, sex, genetics, obesity, diet and infection.¹

BHEL is an engineering and manufacturing company owned by government of India. It manufactures power generation equipments. Bhopal BHEL is a township spread over 20 km² area, with schools, hospital, staff quarters and lush green forest cover. It is inhabited by the workers and their families, who also form the predominant patient group attending our hospital.

It is assumed that people working in industries and their families living in the surrounding areas are more exposed to pollutants produced by the factories, and these may cause higher incidence of gallstones and other diseases in them.⁵

With an aim to find out whether this assumption holds true in case of gallstone diseases and whether any other causal factor is identifiable in these patients, this study was undertaken.

We studied 104 patients with 42.3% male and 57.7% female patients. The M:F ratio was 1:1.36. though this shows a female preponderance, other studies have documented 2-3 times higher incidence in females compared to males.^{1,6} This means that in our study population, males have higher incidence of gallstones as compared to males in general population. Is this a hint that men, as the major part of workforce, are being exposed to something causing them to form gallstones at a higher rate?

Age has been an established risk factor with studies showing incidence of gallstones rising steadily with every passing decade.^{7,8} But in our case, incidence in men peaked at 7th decade (54.54%) while in women, peak was at 6th decade (41.66%). 9 (8.65%) patients, all women, were up to 40 years of age at presentation. This finding supports the theory that women have hormonal factors causing gallstones in them, thus accounting for some young age patients.⁹ Whereas males present later due to prolonged low grade exposure and accumulation of some chemical or heavy metal over years or decades.

Family history

Ethnic predisposition of the gallstones is substantiated by the fact that many patients of gallstones have similar

family history. Also members of one family consume same type of diet, which may account for the positive family history.

According to Sarin et al within a given population, the first degree relatives of patients with gallstones are 4.5 times more susceptible to develop gallstones.¹⁰ In 2002, Nakeeb et al also found that the first degree relatives of patients with gallstones have 2 fold more prevalence of gallstones when compared to normal population.⁶

In contrast, in our study, family history of gallstones could be elicited in only 3 cases (2.89%) (Table 1). This too points towards a cause not found in genes or at home, but something present in the workplace environment.

Parity

Parity is frequently touted as a risk factor for development of gallstones. Maringhini et al found the frequency of new sludge and gallstone formation during pregnancy to be 31% and 2%.¹¹ Increased parity is also associated with increased risk of gallstones, as concluded in the study by Miguel et al in 1998.¹²

In our study, nulliparous women had the least incidence of gallstones (6.67%), and maximum incidence was in women bearing 1-3 children (53.33%) (Table 2). Decline in incidence of gallstone in higher order multiparous women could be explained by the fact that now not many women go for higher order pregnancies; hence the group itself is shrinking in size.

Socio economic status, activity level and BMI

91.33% of our patients were from middle- and high-income groups. Though not directly associated, a better socioeconomic status hints at rich dietary habits and higher BMI to some extent. Strong linear association was found between obesity and the incidence of gallstones in various studies.^{1,13}

Lowest incidence of gallstones was found in active patients (12.5%) in our study group. Majority of patients (46.15%) were overweight while only 26 patients (25.01%) were obese (Table 1). Thus, no positive correlation could be inferred in our study. Similar results were obtained by Attili et al who found no relationship between incidence of cholelithiasis and rising BMI.⁸

Dietary habits

There are numerous studies associating or negating the association of gallstones with intake of dietary fat. According to study by Kern et al, dietary cholesterol (supplied by intake of fat of animal origin) increases cholesterol secretion and decreases the bile salt pool.¹⁴ On the contrary, study by Misciagna et al actually showed an inverse relationship between dietary cholesterol intake and the presence of gallstones.¹³ In our

study also, majority of the gallstone patients (79.80) had intake of fat of plant origin, while only 20.2% consumed fat of animal origin, indicating that dietary cholesterol might actually be protective.

In majority of the patients, fat intake did not exceed their daily requirement. Only in 12 patients (11.54%) was fat intake more than 50 gm/day. Thus overall, total fat consumption did not seem to be a predisposing factor in our patients.

Majority of the patients were vegetarians (68.26%), supporting the findings by McConnell et al that vegetarianism predisposes to cholelithiasis.¹⁵

Diabetes

Studies have reported, time and again, an increased incidence of gallstones in diabetics. It could be because of the fact that diabetes is also associated with hypertriglyceridemia, obesity and gall bladder hypomotility, all of which predispose to cholelithiasis.^{16,17} In our population, of all the 104 gallstone patients, 28 patients (26.92%) were found to be suffering from diabetics (Table 3). This is slightly lower than the 36.6% prevalence reported by Ali et al from Pakistan, and 35.48% by Hazari et al from India.^{18,19}

USG findings

Approximately 90% of the patients with gall bladder malignancy have gallstones but only about 1-2% of the patients undergoing cholecystectomy for gall stone disease are found incidentally to have gall bladder cancer, according to literature. In our study, the incidence of malignancy was 3.84% (4 patients) (Table 4), more among male patients (3 cases) when compared to female patient (1 case). This again indicates towards the theory that other factors like exposure to heavy metals might have a role to play in development of carcinoma at a higher rate in these people as compared to general population.

CONCLUSION

The present study was an epidemiological study of gallstones occurring in the industrial population of BHEL, Bhopal. An attempt was made to correlate the incidence of gallstones with dietary habits, physical activity, BMI, family history and parity in cases of female patients. Males were found to have higher incidence of gallstones as compared to general population and presented at a later age. This suggests that men, as major part of workforce, are being exposed to something causing them to form gallstones at a higher rate. Majority of patients with gallstones had better socioeconomic status, lower activity level, higher parity, vegetarian diets and consumption of plant-origin fats, though in moderate amounts. Association with diabetes was slightly lower while gallbladder malignancy was slightly higher than

what has been previously reported, with male preponderance being a noteworthy finding. Family history of gallstones could be elicited in only 3 cases (2.89%). The findings point towards a cause not found in genes or at home, but something present in the workplace environment. As gallstones have multi-factorial etiology, it is difficult to disassociate their influence and to pin point towards the contribution of any one factor in the present setup. But, there is more that what meets the eye, and further studies are required to confirm or negate the observations made in this study.

Limitations of the study were small study group and inability to directly measure the blood levels of any suspicious causative agent.

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