Original Article

Gallstone disease and its correlates among patients attending teaching hospital of North India

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Abstract

Background: Gallstone disease (GSD) represents a significant burden for healthcare systems worldwide and is one of the most common disorders among patients presenting to emergency rooms with abdominal discomfort. **Aim and Objective:** This study was aimed to find correlates (demographic, dietary, and behavioral) of GSD in patients attending teaching hospital in North India. **Methodology:** A case–control study was conducted from January 2013 to December 2013 among subjects attending outpatient department of general surgery in a teaching hospital. Data collection for both cases and controls was done on a self-designed pretested "interview schedule" which assessed the sociodemographic profile, personal history, medical history, comorbidities, physical examination including anthropometry, and dietary intakes. To measure the strength of association, odds ratio (OR) was calculated. Binary logistic regression was used for multivariate analysis. **Results:** A total of 120 cases and the same number of age- and sex-matched controls were included in final analysis. In binary logistic regression, maximum association was seen with physical inactivity [OR 3.93, confidence interval (CI): 1.98–7.78] followed by current consumption of smokeless tobacco (OR 3.65, CI: 1.65–8.09), current smoking (OR 2.69, CI: 1.13–6.37), nonvegetarian diet (OR 3.10, CI: 1.65–5.83), and fat intake (OR 2.14, CI: 1.14–4.02). Current alcohol consumption (OR 0.90, CI: 0.41–1.98), high waist–hip ratio (OR 1.54, CI: 0.67–3.56), and intake of fruits and green leafy vegetables (OR 1.86, CI: 0.61–5.61) were not significantly associated with GSD. **Conclusion:** Physical inactivity, smokeless tobacco, nonvegetarian diet, current smoking, high fat intake, and family history were found to be risk factors for the development of GSD.

Keywords: Case–control study, demographic, dietary and behavioral risk factors, gallstone disease

Introduction

Gallstone disease (GSD) represents a significant burden for healthcare systems worldwide and is one of the most common disorders among patients presenting to emergency rooms with abdominal discomfort.[1] The prevalence differs not only between countries but also between ethnic groups. Age and gender also influence the prevalence of GSD.[2] Gallstones occur commonly in the Western world.[3,4] Prevalence of gallstones in India was found to be 6.12% in the adult population.[5] Diet is likely to be important as the intake of calories, fats, and proteins affects the cholesterol saturation of bile.[6] Some other potential risk factors for the development of gallstones are obesity, sedentary lifestyle, geriatric age group, female gender, oral contraceptive pills, and family history of gallstones.[1,7,8] This study was therefore aimed to find correlates (demographic, dietary, and behavioral) of GSD in patients attending a teaching hospital in North India.

Methodology

To address the above objective, we conducted a case–control study from January 2013 to December 2013 among subjects attending outpatient department (OPD) of general surgery in a teaching hospital (Smt Sucheta Kripalani Hospital, New Delhi).

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Sample size

The sample size was calculated using Fleiss formula[9] and assuming a case-to-control ratio of 1:1; for power of 80% and level of significance of 95% with an assumption of prevalence of some less common risk factors as 14%.[10] The sample size was calculated to comment on the correlates having odds ratio (OR) of more than 2. Assuming a nonresponse of 10%, the calculated sample size was 116. Therefore, we recruited 120 cases and the same number of controls in the study. Study subjects were selected from OPD of general surgery.

Cases

Consecutive ultrasonography-confirmed case of GSD age 20 years or more presenting in the OPD was enrolled in the study, until the sample size was met. Seriously ill patients with GSD, patients who had psychiatric problems, and patients who did not give consent were excluded from the study.

Controls

Patients above 20 years of age who presented to surgical OPD and were diagnosed negative for gallstones by ultrasonography were taken as control and matched for age and sex. Pregnant females, diagnosed cases of other hepatobiliary disease, and renal stones were excluded.

Data collection

Data collection for both cases and controls was done on a self-designed pretested "interview schedule" which assessed the sociodemographic profile, personal history, medical history, comorbidities, physical examination including anthropometry, and dietary intakes. Modified Kuppuswamy's scale (Consumer Price Index 2015) was used to calculate the socioeconomic status (SES). Dietary assessment was done using the 24-h recall method and food frequency questionnaire as a cross-check, and calculations for nutrient intake were done using Indian Council of Medical Research standards.[11] For the purpose of this study, current smokers and current smokeless tobacco users were defined as those who have smoked or consumed smokeless tobacco in the last 1 year, respectively. Current alcoholics were defined as those who had consumed alcohol in the last 1 year. Assessment of physical activity was done on the basis of activity performed during a typical day at workplace, travel, and in leisure time. Physical activity[6] and anthropometric indices [weight, height, body mass index (BMI), waist and hip circumference, waist–hip ratio (WHR)][12] were calculated for all cases and controls using standard definitions. Cut-off for BMI >23 kg/m^2, WHR >0.80 for females and >0.90 for males, and parity ≥3 were used for analysis. Anthropometric measurements were recorded using standard methods, and instruments that were used for measurement were standardized. Clinical presentations, ultrasonography findings, and final diagnosis were recorded from individual records.

Data management and statistical analysis

Data were recorded in MS Excel, and Epi Info 7 software was used for statistical analysis. Observations have been described in terms of mean, range, and standard deviation for continuous data and in terms of percentages/proportions for categorical data. To measure the strength of association, OR was calculated. Binary logistic regression was used for multivariate analysis to find out different correlates and analyze the independent effects of these correlates on GSD.

Ethical considerations

Ethical approval for this study was provided by the institutional ethical committee of Lady Hardinge Medical College and Associated Hospitals (letter no. LHMC/ECHR/2014/180), and also the informed written consent was obtained from each of the study subject.

Results

A total of 120 cases and the same number of age- and sex-matched controls were included in the final analysis. Almost 70% of the cases were females and 30% males. The proportion of cases in each age group increases as the age group increases [Table 1].

Univariate analysis of demographic and behavioral risk factors shows (except for literacy, SES, and current alcohol consumption) that all the other risk factors enumerated had a statistically significant association with the occurrence of GSD among the study subjects [Table 2]. The strength of association was found to be maximum for family h/o of GSD [OR 3.52, confidence interval (CI) 1.11–11.14]. In female subjects, current oral contraceptive pills' (OCPs) use and multiparity (≥3) were significantly associated with development of GSD. Sedentary physical activity and high WHR were significantly more in cases when compared with controls. Significantly more cases were overweight or obese (BMI ≥23 kg/m^2) when compared with controls. Current consumption of smokeless tobacco and current smoking were also associated with the development of GSD [Table 2].

After analyzing the dietary variables, the nonvegetarian diet was found to be strongly associated with the occurrence of GSD [Table 3]. Cases consumed significantly more than the recommended calories and fats when compared with controls. Intake of less protein than the recommended was significantly associated with the development of GSD [Table 3]. Intake of green leafy vegetables (GLV) and fruits was not found to be associated with development of GSD. The study group was analyzed for the presence of comorbidities, presence of anemia, hypertension, and diabetes, which were significantly higher

Table 1: Distribution of cases according to age and sex

Age group (years)	Male (%)	Female (%)	Total (%)
20-30	6 (16.2)	8 (9.6)	14 (11.7)
31-40	8 (21.6)	19 (22.9)	27 (22.5)
41-50	9 (24.3)	27 (32.5)	36 (30)
51-65	14 (37.8)	29 (34.9)	43 (35.8)
Total	37 (30.8)	83 (69.2)	120 (100)

Table 2: Univariate analysis of demographic and behavioral risk factors among study subjects

Variable	Cases (120)	Controls (120)	OR (95%CI)
Literacy			
Literate	42	35	1.31 (0.76-2.25)
Illiterate	78	85	
SES			
Middle/upper	57	61	0.87 (0.53-1.45)
Lower	63	59	
Parity (females) (*n*=83)			
≥3	62	43	2.75 (1.43-5.29)
<3	21	40	
OCPs (females) (*n*=83)			
Yes	12	4	3.34 (1.03-10.82)
No	71	79	
Family history			
Yes	13	4	3.52 (1.11-11.14)
No	107	116	
Smoking			
Yes	25	13	2.17 (1.05-4.47)
No	95	107	
Smokeless tobacco			
Yes	31	16	2.26 (1.16-4.41)
No	89	104	
Alcohol			
Yes	24	28	0.82 (0.44-1.52)
No	96	92	
Physical activity			
Sedentary	74	44	2.78 (1.65-4.69)
Mod/vigorous	46	76	
BMI			
≥23 kg/m^2	68	51	1.77 (1.06-2.95)
<23 kg/m^2	52	69	
WHR			
High	31	14	2.64 (1.32-5.26)
Normal	89	106	

OR: Odds ratio; CI: Confidence interval; SES: Socioeconomic status; OCP: Oral contraceptive pills; BMI: Body mass index; WHR: Waist-hip ratio

in cases when compared with controls. Hyperlipidemia was, however, not found to be statistically significantly associated with GSD [Table 3].

We further analyze the selected variables using binary logistic regression to adjust confounders, and it was found that maximum association was seen with physical inactivity followed by current consumption of smokeless tobacco, current smoking, nonvegetarian diet, and fat intake. Protein intake was found to be significantly lower in cases when compared with controls. Current alcohol consumption, high WHR, and intake of fruits and GLV were not significantly associated with GSD [Table 4].

Discussion

In this study, the proportion of GSD was increased with increasing age and this has been corroborated by several other authors.[7,8,13-17] A higher proportion of GSD was seen in female subjects (69.2%), and the same findings were seen by other authors.[6-8,13,15]

Table 3: Univariate analysis of dietary variables and comorbidities among study subjects

Variable		Cases (120)	Controls (120)	OR (95%CI)
Diet	Nonvegetarian	71	37	3.25 (1.91-5.53)
	Vegetarian	49	83	
Calories	>RDA	48	33	1.76 (1.02-3.02)
	≤RDA	72	87	
Proteins	>RDA	18	34	0.45 (0.24-0.85)
	≤RDA	102	86	
Fats	>RDA	74	51	2.18 (1.3-3.65)
	≤RDA	46	69	
GLV	>RDA	9	11	0.8 (0.32-2.02)
	≤RDA	111	109	
Fruits	>RDA	3	4	0.74 (0.16-3.40)
	≤RDA	117	116	
Anemia	Yes	86	71	1.75 (1.02-2.30)
	No	34	49	
Hypertension	Yes	38	23	1.95 (1.08-3.55)
	No	82	97	
Diabetes	Yes	22	10	2.47 (1.12-5.47)
	No	98	110	
Hyperlipidemia	Yes	9	4	2.35 (0.70-7.86)
	No	111	116	

OR: Odds ratio; CI: Confidence interval; GLV: Green leafy vegetables; RDA: Recommended daily allowance

We have analyzed different demographic factors and found that SES was not associated with GSD, whereas some studies show that prevalence of GSD is higher in higher SES.[18,19] Current OCP's use and parity ≥ 3 were found to be significantly associated with the development of GSD in female subjects, and the same results were seen in other studies.[6-8,20-22] Whereas some showed no significant association.[23,24] Subjects with family history of GSD were found to be more than three times at higher risk for development of GSD, and the same results were seen in other studies.[22,25]

We also analyzed substance usage and found that subjects who were currently consuming smokeless tobacco and current smokers had twice higher risk of GSD, and this has been corroborated by several authors.[24,25] In contrast, some showed no significant association of smoking and smokeless tobacco with GSD.[24,26] In this study, current alcohol consumption showed protective effect against gallstones but not statistically significant; this has been corroborated by several other authors.[23,26] Hypertension and diabetes mellitus were found to be significantly associated with GSD; the same findings were seen by observed by other authors.[6,14,27] Whereas few studies showed no association between GSD and diabetes.[7,8] Personal risk factors such as sedentary lifestyle, overweight or obesity, and high WHR were significantly associated with development of GSD, and the same results were seen in other studies;[6-8,15-17] whereas in few studies no significant association was seen between these personal risk factors and GSD.[8,28,29]

Univariate analysis of dietary factors showed that nonvegetarian diet increases the risk of gallstones by more than threefold,

Table 4: Multivariate regression analysis of selected variables with GSD among study subjects

Variable	Coefficient β	Adjusted OR	95%CI	*P*
Smoking	0.988	2.69	1.13-6.37	0.025
Smokeless tobacco	1.295	3.65	1.65-8.09	0.001
Alcohol	−0.111	0.90	0.41-1.98	0.784
Physical inactivity	1.368	3.93	1.98-7.78	0.000
WHR	0.431	1.54	0.67-3.56	0.314
Diet	1.131	3.10	1.65-5.83	0.000
Fats	0.762	2.14	1.14-4.02	0.018
Proteins	−1.420	0.24	0.11-0.54	0.001
Fruits or GLV	0.618	1.86	0.61-5.61	0.274

OR: Odds ratio; CI: Confidence interval; WHR: Waist-hip ratio; GLV: Green leafy vegetables

whereas other studies showed no significant association between the type of diet and gallstones.[6,26] Daily intake of high calories and high fats favor the formation of gallstones, and high protein diet shows protective effect against gallstones' formation, and the same results were seen in other studies;[20,25] whereas in some studies intake of calories and fats was not significantly associated with GSD.[30] No association was seen between intake of fruits and vegetables and GSD; the same findings were noted by Sachdeva *et al.*,[6] whereas Zamani *et al.*[7] and Bilal *et al.*[8] found that less intake of fruits and vegetables were significant risk factors for the development of GSD.

We further analyzed data using multivariate binary logistic regression for some selected variables to find the independent effect of these risk factors on GSD, which showed physical inactivity increases the risk of gallstones nearly fourfold followed by current smokeless tobacco consumption and nonvegetarian diet; the latter two increase the risk by more than threefold. Other risk factors such as current smoking and high fat diet also independently increase the risk more than twice. High protein diet was found to have protective effect against gallstones, and no significant association was seen between current alcohol consumption, high WHR, and daily consumption of fruits or GLVs with the development of GSD.

From our study as well as other recent researches, data show that occurrence of GSD is increasing and not limited to "fat, female in their forties." Behavioral and lifestyle factors such as tobacco consumption, smoking, physical inactivity, and unhealthy diet (high calories, high fats, and low proteins) are found to be the significant factors for the development of GSD.

Family physician being in continuous contact with the families and population they serve; they can use the knowledge regarding risk factors of GSD to educate families and communities, it might help in arresting or reversing the increasing trends in magnitude of GSD.

Conclusion

Physical inactivity, smokeless tobacco, nonvegetarian diet, current smoking, and high fat intake were found to be risk factors for the development of GSD as shown by multivariate binary logistic regression analysis. Current use of OCP and parity more than three favor gallstone formation in females. Family history of GSD was also a risk factor for gallstone formation.

Many of these behavioral and dietary risk factors are potentially modifiable by primary prevention. Vegetarian diet with recommended calories and fats and high protein diet should be promoted. We should promote physical activity, and there should be community awareness about harms of smoking and smokeless tobacco consumption.

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Conflicts of interest

There are no conflicts of interest.

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