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ORIGINAL ARTICLE

Risk of Hypertension and Diabetes in Patients with Cholecystectomy

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ABSTRACT

Background: Although cholecystectomy is often considered a straightforward and harmless surgery with minimal long-term impact on a patient's health, it can result in significant increase in metabolic diseases.
Objective: To determine the risk of hypertension and diabetes in patients with cholecystectomy.
Study Design: Retrospective cohort study
Place and Duration of Study: Medical unit 2, Department of General Medicine, Bolan Medical Complex Hospital, Quetta, from 1st January 2016 to 31st December 2020.
Methodology: One hundred cases that underwent cholecystectomy within last 5 years were compared with 100 controls. All patients who had undergone cholecystectomy and were ≥35 years of age, were included. The patients in the control group were compared with cholecystectomy group patients in terms of their demographics, body mass index, systolic and diastolic blood pressure, blood glucose levels, cholesterol level, extent of physical activity and mortality index.
Results: The value of systolic blood pressure and cholesterol tends to increase in the further mean 3.21 (95% confidence interval 0.21 to 6.21), mean8.92 (95% confidence interval 15.09to 2.73) in control group when compared with cholecystectomy group patients mean 1.52 (95% confidence interval 1.51 to 4.52) and mean 14.15 (95% confidence of interval 20.32 to 7.97) while body mass index showed a greater increase in cholecystectomy patients mean 1.52(95% confidence interval 1.51 to 4.52)as compared to control as mean 0.01 (95% confidence interval 0.25 to 0.24).
Conclusion: There is a slight risk of rise in fasting blood glucose levels in patients who have undergone cholecystectomy.
Keywords: Cholecystectomy, Gallbladder, Hypertension, Diabetes mellitus.

INTRODUCTION

Cholecystectomy is a commonly reported procedure which involves removal of the gall bladder. It is surgically performed for a number of conditions including cholecystitis, symptomatic gall stones as well as for polyps present in the gall bladder.[1] The research highlights cholecystectomy as a process, which has minimal risk of complications and long-term health impacts, however it has been proved by advancement in science, that the removal of the gall bladder critically impacts the metabolic system of the body. Although cholecystectomy is often considered a straightforward and harmless surgery with minimal long-term impact on a patient's health, it results in significant changes in the body's digestive metabolism. It is pertinent to mention that the gall bladder stores the bile and the most significant effect of the bile is fat emulsification and absorption.[2] The intestinal microbiome needs to be present in a specific homeostasis state for proper functioning. Literature has shown that gall bladder removal results in the disruption of the enterohepatic circulation which consequently disturbs the intestinal microbiome.[2-4]

Although there is extensive research being conducted on understanding the outcomes of cholecystectomy, yet there is a lack of proper understanding of cholecystectomy's effects in general public.[5] It is being proven that patients who undergo cholecystectomy are more prone to metabolic disease than control cases.[6] However, these studies do not provide an explanation for the intermediate mechanism linking the disease to the post-cholecystectomy state.[7,8]

Diabetes mellitus and hypertension rank among the top causes of metabolic disorders worldwide, hypertension is the most prevalent NCD, affecting 38.7% of the population, while diabetes has a prevalence of 14.6%.[9] According to the National Health Survey of Pakistan, the general population has an 11.0% prevalence of diabetes. This fact combined with the changes in metabolism following surgery may further impact patients' metabolic disease risk.[10] This study purposes to examine the effects that cholecystectomy can have on development of diabetes mellitus and hypertension. By analyzing the health outcomes and risk factors, this research aims to clarify the connection between cholecystectomy and these common conditions and to provide insights that could guide post-operative care, and preventative strategies.

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MATERIALS AND METHODS

This retrospective cohort study was conducted at Medical unit 2, Department of General Medicine, Bolan Medical Complex Hospital, Quetta from 1stJanuary 2016 to 31st December 2020 and ethical approvals were taken for the study. Each enrolled participant was detailed about study background and an informed consent was taken from each participant. All patients who had undergone cholecystectomy and who were ≥35years of age were included. Those patients who were already suffering from metabolic syndrome, before gall stone formation, or having any form of cancer or immune suppression were excluded. A total of 100 cases who underwent cholecystectomy within last 5 years were compared with 100 controls. The samples size was calculated by WHO available sample size calculation website wherein the prevalence of metabolic syndrome in cholecystectomy patients was taken as 25% all over the globe. The power of test used was 80%, with 95% CI and 5% margin of error. Patients were individually interviewed about the variables. For measuring the anthropometric variables like BMI, a digital weight and height measuring scale was used while the blood pressure was measured through digital BP monitor at three various times, twice daily (morning and evening). Blood sugar was tested thorough a well calibrated glucometer, after 8-10 hours of fasting, on three different days. A 3cc blood was withdrawn and serum was separated (through confirmation at 3000 rpm) for analyzing the cholesterol levels through calorimetric method. The patients in the control group were compared with cholecystectomy group patients in terms of their demographic, BMI, cholesterol, fasting blood glucose, systolic, diastolic blood pressure, Charleson mortality

index and the level of physical activity. The data extracted from the aforesaid variables was entered in a well framed questionnaire. The data was analyzed through SPSS 26.0 wherein linear regression models adjusted for confounding factor were used. The confidence interval and risk ratio was analyzed. P value <0.05 was considered as significant.

RESULTS

The mean age of the patients were 45.5±10.2 years in control group while in cholecystectomy group it was 46.2±6.5 years. There was an increase in number of female patients who had undergone cholecystectomy as compared to the males. The cholecystectomy group had slightly increased body mass index, fasting blood glucose and diastolic blood pressure values, more than control however the mean cholesterol level was slightly decreased in cholecystectomy group in comparison to the normal control group (Table 1).

The covariates also included number of exercise times within 1 week (more than 20 minutes/ day).There were a high number of cases who underwent cholecystectomy and were performing minimal or no physical activity in comparison to the control group. However, the difference between the two groups was insignificantly varied. The Charlson Comorbidity Index showed that cholecystectomy group has significantly higher risk ≥2 and represented as observed in 47% of the patients than in control group where it was presented in only 28% patients respectively (Fig.1).

The value of systolic blood pressure and cholesterol tends to increase in the further Mean: 3.21 (95% Confidence interval0.21 to 6.21), mean− 8.92 (95% Confidence Interval − 15.09to − 2.73) in control group when compared with cholecystectomy group patients, mean 1.52(95% Confidence interval −1.51to4.52) and mean − 14.15 (95% Confidence of interval − 20.32to − 7.97) [Table 2].

Table 1: Demographic, blood pressure and glycemic comparison within groups (n=200)

Variable	Control group N=100	Cholecystectomy Group N=100
Age (years)	45.5±10.2	46.2±6.5
Gender		
Male	52 (52%)	45 (55%)
Female	48(48%)	55 (45%)
Body mass index (kg/m^2)	23.9 (22.1–25.9)	24.5 (22.7–27.3)
Systolic BP (mmHg)	129 (119–140)	128 (116–135)
Diastolic BP (mmHg)	80 (70–85)	82 (75–85)
Cholesterol levels (mg/dL)	198 (178–223)	194 (172–226)
Fasting glucose (mg/dL)	95 (84–107)	98 (88–109)

Table 2: Association of blood pressure and cholesterol values, of control, with the cholecystectomy group

Variable (95% CI)	Control group	Cholecystectomy Group	*P* value
Systolic blood pressure (mmHg)			
Mean (SD)	0.06 (17.37)	− 1.42 (16.29)	< 0.0001
Mean	0.24 (− 0.8-0.60)	− 1.32 (−1.88- −0.74)	
Mean	3.21 (0.21-6.21)	1.52(−1.51 - 4.52)	
Total cholesterol (mg/dL)			
Mean (SD)	− 1.32 (34.99)	− 6.39 (36.13)	< 0.0001
Mean	− 1.08 (− 1.73-− 0.42)	− 6.33 (− 7.50-− 5.18)	
Mean	− 8.92 (− 15.09 - − 2.73)	− 14.15 (− 20.32 - − 7.97)	

Mean by linear regression and Adjustment conducted for age

Table 3: Association of blood glucose and body mass index values in control with cholecystectomy

Variable (95% CI)	Control group	Cholecystectomy Group	*P* value
Fasting serum glucose (mg/dL)			
Mean (SD)	0.07 (34.37)	0.31 (31.26)	0.721
Mean	0.21 (− 0.46- 0.85)	0.39 (− 0.74- 1.52)	0.782
Mean	2.49 (− 3.47- 8.43)	2.70 (− 3.27- 8.65)	0.745
Body mass index (kg/m^2)			
Mean (SD)	− 0.07 (1.36)	− 0.19 (1.38)	< 0.0001
Mean	− 0.08 (− 0.07 - − 0.04)	− 0.18 (− 0.23 - − 0.14)	
Mean	0.01 (− 0.25 - 0.24)	− 0.13 (− 0.38 - 0.12)	

Mean by linear regression and Adjustment conducted for age

The value of fasting serum glucose tends to increase in cholecystectomy group Mean: 2.70 (95% Confidence Interval − 3.27 to 8.65) in comparison with the control group Mean 2.49 (95% Confidence interval − 3.47 to 8.43). While BMI showed a greater increase in cholecystectomy patients Mean 1.52(95% Confidence Interval −1.51to4.52) in compared to control as mean 0.01 (95% Confidence interval− 0.25to0.24) [Table 3].

Fig. 1: Variances in physical activity and mortality risk within groups (CG: Cholecystectomy Group; PA: Physical Activity).

DISCUSSION

Cholecystectomy, which is the surgical removal of the gallbladder, is a commonly performed abdominal surgery worldwide. It is often recommended for conditions such as symptomatic gallstones or cholecystitis. Similarly, hypertension and diabetes mellitus are widespread chronic conditions with significant implications on public health, both of which are known to contribute to higher rates of illness and death. New evidence suggests that patients who have had cholecystectomy may experience changes in their metabolic and cardiovascular health, potentially affecting their likelihood of developing this conditions.[11-13]

The results of the present study indicate that undergoing cholecystectomy was linked to a slight increase in fasting blood glucose levels and body mass index. There was also a slight rise of diastolic blood pressure. In an another study, it showed that cholecystectomy increases the risk of developing type 2 diabetes in obese patients[8] while another study has shown rise in systolic blood pressure after cholecystectomy.[9] All these metabolic changes were found to be risk factors for development of cardiovascular disease, in short term, i.e. upto 2 years after cholecystectomy.

Liver injury can be identified through the application of total bile acid (TBA) biomarker.[14-16] During the cholecystectomy it is highly significant to reduce the risk of high blood pressure as well as of diabetes. This can be achieved through improving the metabolic profile through fat inhibition and weight loss.[17-19] It is highlighted from the past findings that the risk of hypertension and diabetes mellitus escalates after cholecystectomy due to increased body mass index and poor metabolic profile.

CONCLUSION

There was a risk of fasting serum glucose rising slightly in patients who had undergone cholecystectomy, otherwise those patients who did not suffer from any critical disease, when they underwent cholecystectomy, had no significant association observed with hypertension or diabetes.

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