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The role of cholelithiasis risk factors in stone types in cholelithiasis patients at Universitas Sumatera Utara Hospital

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ABSTRACT

Introduction: Cholelithiasis is the most common disease in the biliary tract. Several risk factors have been known as risk factors of cholelithiasis, such as obesity and female gender. Meanwhile, only few studies evaluate correlation between clinical characteristics and stone type in cholelithiasis. The study aims to evaluate correlation between clinical characteristics and stone type in cholelithiasis patients at Universitas Sumatera Utara Hospital.

Method: The study design was cross sectional. The sample of this study was 35 people with cholelithiasis patients who underwent cholecystectomy either by open or laparoscopic cholecystectomy at Universitas Sumatera Utara Hospital. Gallstones will be examined by a laboratory. Risk factors assessed were age, gender, body mass index, hemoglobin bilirubin, cholesterol levels. Data analysis will use the Kruskal Wallis test.

Result: From 35 study samples was found the most types of stones were mixed stones with 17 (48.6%). Based on the Kruskal Wallis test found a significant relationship between the type of stone with gender, body mass index, total bilirubin, total cholesterol, high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C).

Conclusion: Factors related to the type of cholelithiasis stone are gender, body mass index, bilirubin levels, total cholesterol levels, HDL-C, and LDL-C.

INTRODUCTION

Cholelithiasis is the most common disease in the biliary tract. It is estimated that 10-15% of the population in western countries suffers from cholelithiasis.[1] Eighty-five percent of these cases are cholesterol stones.[2,3] According to Abbas et al.[4] the prevalence of cholelithiasis occurs in 17% of the Asian population, 10% of the population in Western countries and 11-36% of all world countries. In Indonesia, the incidence of cholelithiasis per year has not been officially published.

The occurrence of stone formation is influenced by several risk factors, such as obesity, sedentary lifestyle, geriatric age group and female gender.[5,6] Hip circumference and parity also determine the prevalence of cholelithiasis.[7]

Types of gallbladder stones can be classified into cholesterol stones (containing cholesterol >50%), mixed stones (containing 20-50% cholesterol), and pigment stones (containing <20% cholesterol).[8] In order to differentiate the types of stones can also be seen from the color such as cholesterol stones will be brownish yellow, pigment stones are amorphous and brittle. Calcium carbonate stones are shaped like black granules, green grains like mud or black, and so on.[9]

Age, obesity, weight loss, multiparity, hyperlipidemia, diabetes mellitus, a high-calorie diet, and the drugs used will reduce storage function and normal motility, causing the formation of cholesterol stones.[10] Meanwhile, cirrhosis, ileal disease, hemolytic anemia, truncal vagotomy, hyperparathyroidism, and bile

duct infection are risk factors for pigment stone formation. Based on this, the researchers assumed that there was a role for cholelithiasis risk factors on the type of stones in cholelithiasis patients. Therefore, the researchers wanted to conduct a study to determine whether there was a role for cholelithiasis risk factors for stone types in cholelithiasis patients. Currently, there is no data on the role of cholelithiasis risk factors for stone types in cholelithiasis patients at Universitas Sumatera Utara Hospital.

METHOD

This research is an analytical study using cross sectional method. The study was conducted at USU Hospital with the time the study was started since the study was

Table 1. Study participant characteristics

Characteristics	Mean (±SD)	n (%)	p-value
Age	47.74 (±7.63)		0.766
Sex			0.023*
Male		12 (34.3)	
Female		23 (65.7)	
Body mass index			0.089*
Underweight		1 (2.9)	
Normoweight		7 (20.0)	
Overweight		19 (54.3)	
Obese		8 (22.9)	
Hemoglobin	12.45 (±1.19)		0.110
Total Bilirubin	0.95 (±0.36)		0.022*
Cholesterol total	189.91 (± 24.52)		0.025*
HDL-C	73.3(± 14.62)		0.048*
LDL-C	95.8 (± 8.93)		0.087*
Stone type			
Cholesterol		6 (17.1)	
Pigmented		12 (34.3)	
Mixed		17 (48.6)	

approved. The research will be carried out in 1 year. The study population was all patients with a diagnosis of cholelithiasis. The sample of this study is a population that fits the criteria of the study which was performed cholecystectomy surgery. The inclusion criteria in this study were cholecystectomy patients either through conventional or laparoscopic methods. The exclusion criteria in this study were the absence of gallbladder stones after surgery. Data analysis in this study used SPSS version 25.0, the Kruskar Wallis test to determine the relationship between the characteristics of the stone type in patients with cholelithiasis. All values are considered significant if p<0.05.

The mean age of the sample in this study was 47.74 (± 7.63) years, consisting of 12 men (34.3%) and 23 women (65.7%). Judging from the most body mass index with overweight category as many as 19 samples (54.3%) and the lowest category is underweight as much as 1 sample (2.9%). The mean hemoglobin level in this study was 12.45 (± 1.19) mg/dl, with the mean total bilirubin level being 0.95 (± 0.36) mg/dl. In terms of total cholesterol levels, it was found that the mean total cholesterol levels in this study were 189.91 (± 24.52) mg/dl, the mean HDL-C levels were 73.3 (± 14.62) mg/dl and the mean LDL-C was 95.8 (± 8.93) mg/dl. Whereas for stone types, mixed stones were the most

stone types with 17 samples (48.6%), and cholesterol stones with the least amount of 6 samples (17.1%) (Table 1).

Based on the analysis of the Kruskal Wallis test, there was a significant relationship between stone type and gender, body mass index, total bilirubin levels, total cholesterol, HDL-C, and LDL-C levels with p-value <0.05. Meanwhile, age and hemoglobin levels do not play a role in the formation of stone types (Table 1).

DISCUSSION

The occurrence of stone formation is influenced by several risk factors, namely obesity, sedentary lifestyle, geriatric age group and female gender.[5,6] In this study, there were 35 patients who had cholelithiasis, with the mean age of the sample in this study was 47.74 ± 7.63 years. The frequency of cholelithiasis increases with age, increasing sharply to be 4 to 10 times more common in patients over 40 years of age.[11]

In this study, it was found that the number of female patients was more than the number of male patients [12 male (34.3%) and 23 female (65.7%)]. Female sex is twice as likely to have cholelithiasis at the time of fertility / before menopause (<40 years) when compared to men, related to female sex hormone (estrogen);

parity, the use of oral contraceptives and estrogen replacement therapy.[12,13] The hormone estrogen plays a role in cholesterol formation in the gallbladder by increasing cholesterol saturation.[14]

In this study, it was found that body mass index affects the type of gallbladder stones with a p-value of 0.089. This is similar to the study of Dhamnetiya et al.[6] which states that a BMI >23 kg/m² is strongly associated with gallstones, due to fat accumulation in adipose tissue increases cholesterol synthesis, biliary cholesterol secretion, cholesterol supersaturation, and promotes stone formation. Increased BMI has been associated with increased residual volume after gallbladder contraction, impaired contractility, and reduced sensitivity to cholecystokinins, which normally stimulate gallbladder contraction, all of which support bile stasis and gallstone formation.[15] This is also supported by the study of Moghaddam et al.[16] which states that obese persons will have a two times greater risk of suffering from cholelithiasis compared to normal body mass index.

Judging from the hemoglobin levels in this study, it was found that the mean hemoglobin level in cholelithiasis patients was 12.45 (± 1.19) mg/dl with a p-value >0.05. In contrast to the study by Kim et al.[13] stated that hemoglobin levels were associated with the incidence of cholelithiasis with a p-value <0.05. In this study, total bilirubin levels affected the type of gallbladder stones with a p-value of 0.022. This is consistent with research by Kim et al.[13] which states that bilirubin levels are associated with cholelithiasis with a p-value <0.05. The presence of a gene variant encoding UGT1A1 [uridine5-diphosphate (UDP)-glucuronosyltransferase 1A1] that plays a role in conjugation of bilirubin correlates with the risk of gallstones.[17]

In the study, it was found that the mean total cholesterol level was 189, 91 (± 24.52) mg/dl and with a p-value of 0.025. This is similar to the study by Moghaddam et al.[16] which states that cholesterol is a risk factor for the formation of gallstones. The development of gallstones is caused by an increase in the secretion of bile cholesterol. This increase is due to the increased activity of HMGCoA reductase.[17]

In this study, mixed stones were the most common type of stone, found in 17 people (48.6%), followed by pigment stones 12 people (34.3%), and cholesterol with 6 people (17.1%). This is comparable with a study conducted by Chandran et al.[18] which stated that of the 200 gallstones studied in the population of Haryana, India, 76 of them were mixed stones (38%).

CONCLUSION

The factors associated with cholelithiasis stone types were gender, body mass index, bilirubin levels, total cholesterol levels, HDL and LDL. The most common type of cholelithiasis stone is a type of mixed stone.

CONFLICT OF INTEREST

The authors declare there is no conflict of interest regarding publication of this article.

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ETHICAL STATEMENT

This study has been approved by Ethical Committee, Faculty of Medicine, Universitas Sumatera Utara, Medan-Indonesia.

AUTHOR CONTRIBUTION

Denny Rifsal Siregar is responsible for data gathering, project administration, conceptualization, statistical analysis and writing the original draft. Adi Muradi Muhar is responsible for visualization, supporting project administration, and supporting writing the original draft.

Doddy Prabisma Pohan is responsible for statistical analysis and supports writing the original draft. All authors had reviewed and agreed for the final version of the manuscript.

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