

## Relationship Between Age, Gender, and Comorbids with the Profile of Gallstone Types in Cholecystectomy Patients

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### ABSTRACT

Cholelithiasis, the formation of gallstones in the gallbladder or its ducts, is generally asymptomatic and is only detected incidentally through imaging (60–80% of cases are asymptomatic). Serious complications such as biliary colic, acute cholecystitis, cholangitis, and pancreatitis have been reported in some patients when stones obstruct bile flow. Several studies have shown that age, gender, and the presence of comorbidities such as obesity and diabetes mellitus play a significant role in the development of certain types of gallstones. Objective: To determine the relationship between age, gender, and comorbidities with the profile of gallstone types in cholecystectomy patients at Haji General Hospital, Surabaya, in 2023–2024. Method: This study used a retrospective descriptive approach with a cross-sectional study design. The population in this study consisted of patients at Haji General Hospital, Surabaya, who were diagnosed with cholelithiasis and undergoing cholecystectomy therapy. The sample inclusion criteria included patients with a profile of gallstone types documented in the medical records of the Clinical Pathology Laboratory at Haji General Hospital, Surabaya, following cholecystectomy procedures. The sampling method in this study used the total sampling method. Results: The majority were female, comprising 51 people (65.4%). The most significant number of respondents was in the 40–59 years age group, with 36 people (46.2%). Most respondents suffered from mixed types of stones, namely 67 people (85.9%). Respondents did not have comorbidities in 52.6% of cases; the rest had comorbidities in various forms, including others (26.9%), hypertension (10.3%), and diabetes mellitus (10.3%). Conclusion: There was no significant relationship between age, gender, and comorbidities with the type of gallstones in cholecystectomy patients ( $p > 0.05$ ).

**KEYWORDS:** Age, Gender, Comorbidities, Gallstone type profile, Cholecystectomy

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### INTRODUCTION

Gallstones are collections of crystals that form in the gallbladder or its ducts, and are generally composed of cholesterol, bilirubin, and bile components. These stones often cause no symptoms and are only detected incidentally through imaging tests. However, in some cases, gallstones can cause serious complications such as biliary colic, acute cholecystitis, cholangitis, or pancreatitis. Biliary colic is typically characterized by intermittent right upper abdominal

pain, often triggered by consuming fatty or spicy foods, as the gallbladder contracts against the stone that is blocking bile flow (Jones et al., 2025).

Gallstone formation is caused by impaired gallbladder contraction, decreased bile emptying, and elevated cholesterol or bile salt levels. Complications from gallstones can involve the pancreas, liver, biliary system, and other parts of the digestive tract, making this condition a leading cause of gastrointestinal distress in the United States.

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Therefore, prompt detection and treatment are crucial to prevent serious consequences, with cholecystectomy being the standard treatment for symptomatic cases. (Jones et al., 2025)

Cholelithiasis is a type of gallbladder disease that ranges from asymptomatic patients to patients with frequent episodes of biliary colic. Gallstone-related complications, such as choledocholithiasis and cholecystitis, can occur. Therefore, the definitive treatment for symptomatic gallstones is cholecystectomy (Tanaja et al., 2025). Gallstones are composed of insoluble bile components: cholesterol, calcium bilirubinate, calcium salts (organic and inorganic), bile salts, and mucin glycoproteins. In the United States, 75–85% are cholesterol stones, and 15–25% are pigment stones.

In Western countries, such as the United States and Northern Europe, the prevalence of cholelithiasis ranges from 15% to 25%, with a higher incidence in women than in men. Women of childbearing age have a 2–3 times greater risk than men, primarily due to the influence of the hormones estrogen and progesterone (Di Ciaula et al., 2022). In Indonesia, epidemiological data on cholelithiasis are still limited. However, based on hospital data, cholelithiasis is one of the most common causes of acute abdominal pain requiring surgery. Local studies from several referral hospitals indicate that cholelithiasis is more common in women aged 40–60 years, especially those with a history of multiparity, obesity, and high-fat consumption (Utami et al., 2021).

Only 10% of cholesterol stones are pure (containing at least 90% cholesterol); the remainder are mixed, with at least 60% cholesterol by weight. Cholesterol monohydrate precipitates when it is no longer soluble in bile. Initially, bile is supersaturated with cholesterol, followed by nucleation (initial crystallization), and stone growth is facilitated by bile stasis and mucin hypersecretion. Pure and mixed stones occur primarily in women. They are also associated with increasing age, obesity, rapid weight loss, diabetes, ileal disease, multiple pregnancies, total parenteral nutrition, various medications, and certain ethnic groups. Pigment stones are associated with increasing age. Cholesterol is less than 25–35%. They consist of calcium bilirubinate, calcium salts, and mucin glycoproteins. Brown (not black) gallstones are associated with bile infection (usually *E. coli*) due to acute cholecystitis or choledocholithiasis with cholangitis. Black stones are related to advanced age, chronic hemolysis, cirrhosis, and sclerosing cholangitis (increased unconjugated bilirubin in the bile).

Various studies have shown that age, gender, and the presence of comorbidities such as obesity and diabetes mellitus play a significant role in the formation of certain types of gallstones. In developing countries, trends in dietary changes, increasing obesity, and epidemiological transitions also influence the profile of patients with cholelithiasis. However, to date, there are no data available describing the relationship between age, gender, and comorbidities and

gallstone types in patients undergoing cholecystectomy at Haji General Hospital, Surabaya. Furthermore, clinical trends also indicate an increase in cholelithiasis cases in young people (<40 years), which were previously more common in older age groups. This shows a shift in epidemiological characteristics that has not been widely studied locally. Therefore, this study was conducted to investigate the relationship between age, gender, and comorbidities and the profile of gallstone types in patients undergoing cholecystectomy at Haji General Hospital, Surabaya, from 2023 to 2024.

### METHODS

This study is a retrospective, descriptive research design. With a cross-sectional observational design, the researcher collected data from medical records of patients who had received cholecystectomy therapy and did not provide any treatment or intervention to the research subjects. The research location is the Clinical Pathology Laboratory of General Hospital Haji Surabaya, located at Jalan Manyar Kertoadi No. 10, Klampis Ngasem, Surabaya. The research was conducted from August to September 2025, spanning a period of six weeks.

The research population consisted of all patients at General Hospital Haji Surabaya with a diagnosis of cholelithiasis who underwent cholecystectomy therapy and had available gallstone type profiles in the medical records of the Clinical Pathology Laboratory during the period from January 2023 to December 2024. The sample in this study was patients at RSUD Haji Surabaya with a diagnosis of cholelithiasis who underwent cholecystectomy and received cholecystectomy therapy, and had available gallstone type profiles.

The inclusion criteria for this study were patients at Haji Surabaya Regional General Hospital diagnosed with cholelithiasis who received cholecystectomy therapy and had gallstone profile data available in the Clinical Pathology Laboratory medical records for the period January 2023 to December 2024. The exclusion criteria were patients diagnosed with cholelithiasis who did not receive cholecystectomy therapy. The sampling technique used in this study was total sampling, a sampling method where the number of samples equals the size of the population.

The collected data were summarized in Microsoft Excel to visualize the distribution of numbers and percentages, and then bivariate analysis was conducted using IBM SPSS Statistics 29. The test used in this study was the chi-square test. This study has passed the ethical feasibility test at the health research ethics committee of the Haji Regional General Hospital, East Java Province, with ethics number No. 445/148/KOM.ETIK/2025.

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## RESULTS

The descriptive analysis of this study shows that of the 78 respondents, the majority were female (51 respondents) (65.4%), while 27 respondents were male (34.6%). (Table 1).

**Table 1. Distribution of Respondents' Gender Characteristics**

| Gender | n  | Percentage (%) |
|--------|----|----------------|
| Male   | 27 | 34,6 %         |
| Female | 51 | 65,4%          |
| Total  | 78 | 100%           |

The age distribution of the largest respondents was in the 40–59 years age group, namely 36 people (46.2%), followed by those aged <40 years, as many as 26 people (33.3%), and those aged ≥60 years as many as 16 people (20.5%) (Table 2).

**Table 2. Distribution of Respondents' Age Characteristics**

| Age             | n  | Percentage (%) |
|-----------------|----|----------------|
| <40 years old   | 26 | 33,3 %         |
| 40-59 years old | 36 | 46,2 %         |
| > 60 years old  | 16 | 20,5 %         |
| Total           | 78 | 100%           |

When viewed by the type of stone, the majority of respondents suffered from mixed rocks, with 67 people (85.9%), while pigment stones were found in 11 people (14.1%). (Table 3)

**Table 3. Characteristics of Stone Types**

| Stone Type    | n  | Percentage (%) |
|---------------|----|----------------|
| Pigment Stone | 11 | 14,1 %         |
| Mixed Stones  | 67 | 85,9%          |
| Total         | 78 | 100%           |

In terms of comorbidities, more than half of the respondents (41 people) had no comorbidities. The remainder had comorbidities in the form of other diseases (21 people) (26.9%), hypertension (8 people) (10.3%), and diabetes mellitus (8 people) (10.3%) (Table 4).

**Table 4. Characteristics of Comorbidity Types**

| Comorbidity       | n  | Percentage (%) |
|-------------------|----|----------------|
| No comorbidities  | 41 | 52,6 %         |
| Hypertension      | 8  | 10,3 %         |
| Diabetes Mellitus | 8  | 10,3 %         |
| Other             | 21 | 26,9 %         |
| Total             | 78 | 100%           |

The correlation test between gender and stone type revealed that women were more likely to suffer from mixed stones (82.4%) than from pigment stones (17.6%). In contrast, men had a similar proportion, specifically 92.6% for mixed stones and 7.4% for pigment stones. However, the chi-

square test yielded a p-value of 0.216 (>0.05), indicating no significant correlation between gender and stone type. Thus, the distribution of stone types was not influenced by the respondents' gender (Table 5).

**Table 5. Analysis of the relationship between gender and stone type**

| Variabel      | Male   | Female | P value |
|---------------|--------|--------|---------|
| Mixed Stones  | 92,6 % | 82,4 % | 0,216   |
| Pigment Stone | 7,4%   | 17,6%  |         |

Table 6 shows an analysis of the relationship between age and stone type, showing that the age group <40 years tended to experience more mixed stones (92.3%) than pigment stones (7.7%). In the age group ≥60 years, the proportion of pigment stones was slightly higher (25%) than in other age groups, although the majority remained mixed stones.

**Table 6. Analysis of the relationship between age and stone type**

| Variabel  | Campuran | Pigmen | P Value |
|-----------|----------|--------|---------|
| <40 tahun | 92,3%    | 7,7 %  | 0,293   |
| ≥60 tahun | >25%     | >25 %  |         |

The chi-square test yielded a p-value of 0.293 (>0.05), indicating no significant association between age category and stone type. This indicates that age does not significantly influence the type of stone experienced by patients (Table 6).

Meanwhile, an analysis of the relationship between comorbidities and stone type showed that patients without comorbidities predominantly experienced mixed stones (92.7%). In the group with comorbidities such as diabetes mellitus, hypertension, or other diseases, the majority also experienced mixed stones, with a proportion of >25% (Table 7)

**Table 7. Analysis of the relationship between comorbidities and stone types**

| Comorbidity       | Mixed Stones | Percentage (%) |
|-------------------|--------------|----------------|
| No comorbidities  | 92,7%        |                |
| Hypertension      | >75%         |                |
| Diabetes Mellitus | >75%         | 0,262          |
| Other             | >75%         |                |
| Total             | 78           | 100%           |

The chi-square test yielded a p-value of 0.262 (>0.05), indicating no significant association between the presence of comorbidities and stone type. Therefore, the presence of comorbidities was not shown to influence stone type in this study sample significantly.

**Discussions**  
Among Chinese adults (≥18 years), the crude prevalence of gallstones was 4.73%, and the prevalence was

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5.13% (95% CI: 5.11–5.14%). The prevalence of gallstones, regardless of anatomical location, increased significantly with age ( $P < 0.001$ ), especially for GB stones whose prevalence increased from 1.05% (age  $< 30$ ) to 11.60% (age  $\geq 70$ ) ( $P < 0.001$ ), and for extrahepatic stones whose prevalence increased from 0.21% (age  $< 30$ ) to 6.43% (age  $\geq 70$ ) ( $P < 0.001$ ) (Song et al., 2022). The results of this study showed that the majority of patients were women. Women have a 2 to 3 times greater risk of developing cholelithiasis than men, especially during the reproductive years. This is due to the influence of the hormone estrogen, which increases cholesterol secretion and decreases gallbladder motility. The risk also increases with age, especially over 40 years (Ciaula et al., 2022).

Based on the patient distribution above, and in accordance with previous research, gallstone risk factors are more frequently observed in obese women over the age of 40. Further epidemiological review showing that gallstone prevalence increases with age and is higher in females (Wang X, et al, 2024). Obesity and lifestyle changes are identified as key contributing factors. The prevalence of gallstones increased with increasing BMI, fasting glucose level, or total triglyceride level. Additionally, the prevalence of extrahepatic stones increased with increasing fasting glucose level or total triglyceride level. In contrast, the prevalence of intrahepatic stones decreased in individuals with a BMI  $\geq 25.0$ , fasting glucose  $\geq 7$ , or total triglyceride level  $\geq 2.27$ . The prevalence of each gallstone subtype varied across city scales ( $P < 0.001$ ), and the prevalence of gallstone disease was consistently lowest among the three subtypes in individuals from large cities.

Unlike a previous study in 2008 that showed a slightly higher age-standardized prevalence of gallstones in men (4.4%) than in women (4.3%) (Stinton, 2020 & Gu 2020; Zu 2014), we found that the overall prevalence of SGPT gallstones was higher in women (5.41% vs. 4.85%). Our results align with those of previous studies from other parts of Asia, Europe, and the US (Song, 2022).

Risk factors for gallstones in China and Western countries may differ significantly. Unlike Western populations, where 90–95% of gallstones form in the gallbladder (Association), approximately 25% of gallstone cases in the Chinese population are intrahepatic, which is thought to be related to chronic biliary tract infection (Shaffer, 2006). Consistent with findings from other studies (Song, 2020), female gender, advanced age, and metabolic disorders, as reflected by higher BMI, fasting glucose, or total triglycerides, were strongly correlated with gallstones, but not with intrahepatic stones. Conversely, the prevalence of intrahepatic stones was even higher in individuals with lower BMI, fasting glucose, or total triglyceride levels. Furthermore, the prevalence of SGPT in gallstones and intrahepatic stones was not correlated among 30 provinces. In contrast, the prevalence of gallstones and extrahepatic SGPT was highly correlated among the 30 provinces (Spearman

test,  $r = 0.77$ ,  $P < 0.05$ ), indicating that extrahepatic stones tend to coincide with gallbladder stones or result from the passage of stones from the gallbladder to the extrahepatic bile ducts.

Chronic diseases, such as diabetes mellitus, also increase the risk of gallstone formation due to neuropathy, which leads to reduced gallbladder wall contractility (Lammert, 2016). Patients with type 2 diabetes mellitus are at higher risk of developing cholelithiasis due to gallbladder hypomotility caused by autonomic neuropathy and lipid metabolism disorders that lead to increased bile cholesterol levels (Indar & Beckingham, 2021).

The etiology of gallstones and chronic cholelithiasis is a significant factor in the development of gallstone disease (Marimoto, 2021). Obesity, especially central obesity, is a considerable risk factor for cholelithiasis. The presence of insulin resistance in metabolic syndrome can lead to increased hepatic cholesterol synthesis and decreased bile salt secretion. This leads to cholesterol supersaturation in bile (Zhao et al., 2019). High intakes of saturated fat and cholesterol contribute to increased cholesterol levels in bile. Meanwhile, low fiber consumption disrupts lipid metabolism and prolongs colonic transit time, which can lead to increased bile and cholesterol reabsorption (Ciaula et al., 2022).

With the dominant findings being mixed cholesterol stones, this study also emphasizes the need for further research with a larger population to explore the relationship between metabolic risk factors and the type of gallstones formed more deeply.

## CONCLUSION

The majority of gallstones found were mixed stones with a predominance of cholesterol, while pigment stones were present in small numbers, and pure cholesterol stones were not found. Statistical analysis did not show a significant association between gallstone type and the presence of comorbid diabetes mellitus or hypertension ( $p > 0.05$ ). However, theoretically, both metabolic diseases are often associated with the mechanism of cholesterol stone formation.

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