DOI: 10.24938/kutfd.590975 Kırıkkale Üniversitesi Tıp Fakültesi Dergisi 2019;21(3):353-358
Original Article *Özgün Araştırma*

CLINICAL UTILITY OF RADIOLOGICAL IMAGING IN THE EVALUATION OF GALLSTONE ILEUS

Safra Taşı İleusu Değerlendirmesinde Radyolojik Görüntülemenin Klinik Faydası

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ABSTRACT

Objective: Gallstone ileus is a rare complication of cholelithiasis. It occurs as a result of the passage of bile stones into intestinal system via bilioenteric fistulae, which are formed by recurrent attacks of cholecystitis, and obstruction of the intestinal lumen. The objective of our study was to discuss the imaging findings of gallstone ileus among patients diagnosed at our center.

Material and Methods: Among patients that admitted to our hospital's radiology department between December 2016 and January 2019, the medical records of those with a history of gall bladder stone detected on ultrasonography were retrospectively evaluated. Among those, cases of gallstone ileus were identified. Admission complaints, age, sex, comorbidities, radiological imaging findings, fistula localization, stone size, and obstruction level were recorded and analyzed.

Results: Among 958 patients with bile stones, 342 (35.7%) were male and 616 (64.3%) were female. Gallstone ileus was identified in five patients. Three of them were female (mean age 76.67± 13.05 years) and 2 were male (mean age 59±1.41 years). Ileus signs were detected on plain radiograms for all patients. The gallbladders were not clearly visualized by ultrasonography in any of patients with gallstone ileus. A diameter increase suggestive of ileus was detected in visualizable intestinal segments. Computed tomography to identify the cause of ileus revealed air in the bile ducts, cholecystoduodenal fistula, stones in intestinal lumen, and an appearance consistent with ileus proximal to that segment. The mean size of the stones was 26.20±16.3 mm (16-55 mm).

Conclusion: Although gallstone ileus is a rare cause of intestinal obstruction, it should be definitely remembered in the differential diagnosis in patients with advanced age and a history of cholelithiasis who present to the emergency department.

***Keywords**: Gallstone ileus, cholelithiasis, bilioenteric fistula, computed tomography*

ÖZ

Amaç: Safra taşı ileusu kolelitiazisin nadir bir komplikasyonudur. Tekrarlayan kolesistit atakları sonucu gelişen kolesistoduodenal fistül yolu ile safra kesesi taşının intestinal sisteme geçmesi sonucunda oluşur. Çalışmamızın amacı merkezimizde safra taşı ileusu tanısı alan hastaların görüntüleme bulgularını sunmaktır.

Gereç ve Yöntemler: Aralık 2016- Ocak 2019 tarihleri arasında hastanemiz radyoloji birimine başvuran hastalardan ultrasonografi tetkikinde safra kesesi taşı öyküsü olan hastaların dosyaları retrospektif olarak incelendi. Bu hastalardan safra taşı ileusu tanısı alan hastalar tespit edildi. Hastaların hastaneye geliş şikayetleri, yaşları, cinsiyetleri, eşlik eden hastalıkları ve radyolojik görüntüleme bulguları ile fistül lokalizasyonu, taşın boyutu, obstrüksiyon seviyeleri değerlendirildi.

Bulgular: Bilinen safra taşı öyküsü olan 342'si (%35.7) erkek, 616'sı (%64.3) kadın toplam 958 hastadan safra taşı ileusu tanısı alan 5 hasta tespit edildi. Hastaların 3'ü kadın (yaş ortalaması 76.67±13.05/ yıl), 2'si erkek (yaş ortalaması 59±1.41 /yıl) idi. Hastaların direkt grafilerinde ileus bulguları mevcuttu. Yapılan ultrasonografi tetkikinde tüm hastalarda safra kesesi net olarak vizüalize edilemedi. Değerlendirilebilen barsak segmentlerinde ileusu düşündürecek çap artışı tespit edildi. İleus nedenine yönelik yapılan bilgisayarlı tomografide hastaların hepsinde intrahepatik safra yollarında hava, kolesistoduedonal fistül, barsak lümeninde taşlar ve bu seviye proksimalinde ileus ile uyumlu görünüm izlendi. Taşların boyutları ortalama 26.2±16.3 mm (16-55 mm) idi.

Sonuç: Safra taşı ileusu intestinal obstrüksiyonun nadir nedenlerinden biri olmakla birlikte intestinal obstrüksiyon bulguları ile acile başvuran ileri yaş ve kolelitiazis öyküsü olan hastalarda safra taşı ileusu mutlaka akla gelmelidir.

***Anahtar Kelimeler**: Safra taşı ileusu, kolelitiazis, kolesistoduodenal fistül, bilgisayarlı tomografi*

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Received / Geliş Tarihi: 11.07.2019 **Accepted** / Kabul Tarihi: 15.11.2018
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Doi: 10.24938/kutfd.590975

INTRODUCTION

Bartholin identified cholecystoenteric fistula and stones in the small bowel lumen in postmortem examinations for the first time in 1654 (1). In 1980, Courvoisier described the first bile stone cases and reported a mortality rate of 44%in a 131-case series (2). Air presence in bile ducts, signs of small bowel obstruction, and visualizing stone in the small bowel lumen are the plain radiographic signs of gallstone ileus (GSI), and were first described by Rigler et al. in 1941 (3). Different radiologic imaging modalities such as conventional plain radiographs, computed tomography (CT), gastroscopy, and fluoroscopy are used of the diagnosis of GSI (4). Given its superiority for the visualization of GSI, CT is currently the most commonly utilized method for this indication.

GSI is a rare complication of cholelithiasis. It occurs as a result of the passage of bile stones into the intestinal system via bilioenteric fistulae formed by recurrent attacks of cholecystitis, and obstruction of the intestinal lümen (1). Bile stones are responsible for about 1%to 4%of all mechanical small intestinal obstructions (5). However, 80%of bile stones passing into intestinal lumen through a bilioenteric fistula are excreted without causing signs and symptoms (6). The most common locations of fistulae are, in descending order, cholecystoduodenal, cholecystocolonic, and cholegastric regions (7).

The aim of our study is to present the imaging findings and complications of patients with GSI, an extremely rare condition.

MATERIALS AND METHODS

This study was performed in compliance with the principles of the Helsinki Decleration between December 2016 and January 2019. Ethics Committee approval was obtained (Date: 02.01.2019, Decision number: 2019.01.01). Informed consent form was obtained from the patients for their consent before the imaging procedure. Among patients referred to our hospital's radiology department, patients with a history of bile stones were retrospectively evaluated. Admission complaints, age, sex, comorbidities, radiological imaging studies, location of bilioenteric fistula, stone size, and the level of obstruction were recorded.

Patients who tolerated oral intake (2 patients) were administered 500 ml water containing a water-soluble contrast material either via oral route or through a nasogastric tube 2 hours prior to radiological examination. A 64-slice CT (MSCT; Brilliance 64, Philips Medical System, Best, the Netherlands) was used to obtain CT images. The scan parameters were as follows; tube voltage=120 kV, mAs=350, slice thickness=3.00 mm, field of view (FOV)=180 mm, and image matrix=768x768). The distance set between the upper hepatic margin and the lower margin of the pubic bone was scanned to take the precontrast images with a section thickness of 3 mm. By repeating the same procedure 60 seconds after IV contrast administration, portal phase images were taken. The acquired images were then used to prepare multiplanar reconstructions which were evaluated by an expert radiologist with a 10-year experience in abdominal radiology.

Ileus was defined as a small bowel segment width exceeding 25 mm; a collapse distal to obstruction; and the presence of minimal or no gas in colonic segments on tomographic sections.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) software, Version 24.0 (SPSS, Chicago, IL, USA) was used to calculate the frequency and percentage of categorical variables. The statistical analyses were performed using descriptive statistical analysis methods.

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RESULTS

Of the 958 patients with bile stones, 342 (35.7%) were male and 616 (64.3%) were female. GSI was detected in five (0.5%) patients of which three were female (mean age, 76.6±13 years) and two were male (mean age 59±1.4 years). The clinical features and comorbidities of the patients were summarized on Table 1.

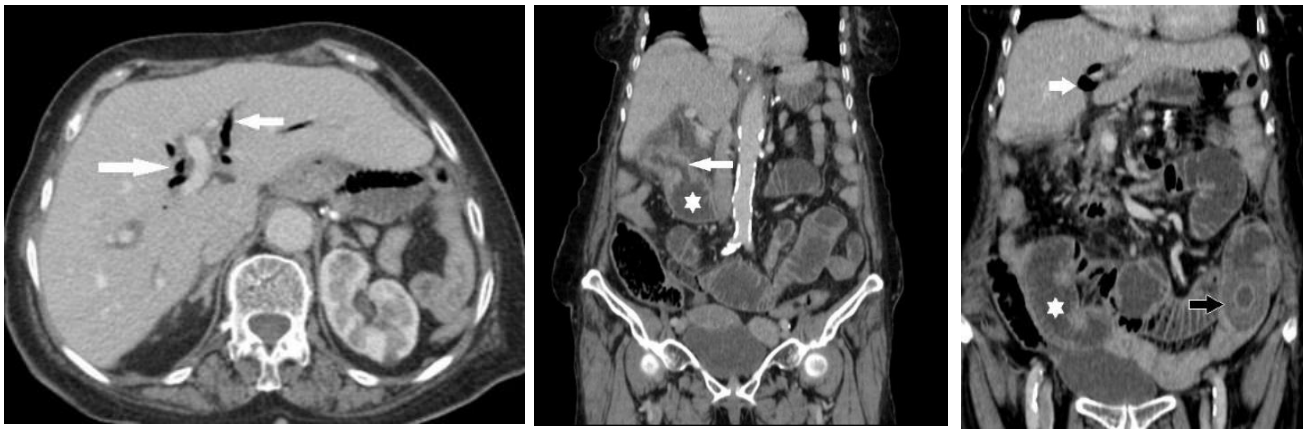
Plain radiograms showed air-fluid levels in all patients. Ultrasonography (US) was inadequate to clearly visualize the gallbladder but detected a diameter increase in the visualized intestinal segments, which was suggestive of ileus, in all patients. Abdominal CT exhibited air in intrahepatic bile ducts, cholecystoduodenal fistula, stones in intestinal lumen, and signs of ileus proximal to that segment (Figure 1).

Pneumobilia was detected by plain radiography in 1 (20%) patient; by US in 2 (40%) patients; and by CT in 5 (100%) patients. Radiographic imaging features of the patients were presented in Table 2.

All patients had a single stone responsible for the obstruction. The mean size of bile stones was 26.2±16.3 mm (16–55 mm). The obstruction was at the ileojejunal level in 3 (60%) patients; at the proximal jejunal level in 1 (20%) patient; and at the level of the ileocecal valve in 1 (20%) patient.

Table 1: Clinical characteristics of the patients

	Gender	**Age (year)**	**Clinical Findings**			**Comorbid Disease**	
			Vomiting	Abdominal Pain	Inability to pass gas or stool	Diabetes Mellitus	Hypertension
Case 1	Female	62	+	+	+	+	-
Case 2	Female	81	-	+	-	-	-
Case 3	Male	58	+	+	+	+	-
Case 4	Male	60	+	+	+	-	+
Case 5	Female	87	-	+	+	-	+
Percentage (%)			60	100	80	40	40



a **b** **c**

Figure 1: a. Air within the biliary tree (pneumobilia) is shown at the axial section of computed tomography imaging (white arrows). b. A fistula tract (white arrow) is seen between the duodenum (white star) and the gallbladder at the coronal section of computed tomography imaging. c. Air in the biliary tree (white arrow), intestinal dilatation (white star), and stone in the ileojejunal junction (black arrow) are seen at the coronal section of computed tomography imaging.

Table 2: Radiographic imaging features of the patients

	Obstruction Signs			**Pneumobilia**			**Stone**			**Localization of Bilioenteric Fistula**	**Level of obstruction**
	PAR	*US*	*CT*	*PAR*	*US*	*CT*	*PAR*	*US*	*CT*		
Case 1	+	+	+	-	+	+	-	-	+	Cholecystoduodenal	İleojejunal
Case 2	+	+	+	-	+	+	-	-	+	Cholecystoduodenal	İleojejunal
Case 3	+	+	+	-	-	+	-	-	+	Cholecystoduodenal	Proksimal jejunal
Case 4	+	+	+	-	-	+	-	+	+	Cholecystoduodenal	İleojejunal
Case 5	+	+	+	+	-	+	+	+	+	Cholecystoduodenal	İleocecal
%	100	100	100	20	40	100	20	40	100		

PAR, Plain Abdominal Radiography; US, Ultrasonography; CT, Computed Tomography

DISCUSSION

GSI, an extremely rare cause of ileus, is associated with such a high mortality rate, a thorough knowledge of the clinical and radiological features of this condition is imperative. The mortality rate associated with GSI ranges between 12-27% (4). Comorbid conditions substantially affect the condition's mortality rate. In our study, 2 patients had diabetes mellitus and 2 others had hypertension. Mortality rate was 0% among our patients with GSI. Prevalence of GSI is only in 0.3 - 0.5% of all cholelithiasis cases (5). Several previous studies have reported that the incidence of GSI is higher in women as a result of a higher prevalence of bile stones in that gender (1,4,8). Our study demonstrated that 0.5% of the patients diagnosed with bile stones had GSI and 60% of the patients with GSI were women.

Clinical findings and laboratory results are not specific in GSI (6). A study reported that signs of small bowel obstruction, pneumobilia, and signs of ectopic bile stones, also known as the Rigler triad, were detected by plain radiogram in 15% of cases; by ultrasonography in 11%; and by CT in 77% (9,10). Pneumobilia is seen in 30-40% of patients (5). All of our patients had pneumobilia. Furthermore, while the Rigler triad was detected in one patient by plain radiogram and all patients by CT examination, US was unable to identify any patient with the Rigler triad in our study.

Mechanical obstructions secondary to bile stones constitute about 1-4% of all intestinal obstructions (11) (Figure 2). Intestinal obstruction usually occurs when a stone is larger than 25 mm (12). Obstruction usually involves terminal ileum, but also less commonly proximal ileum, jejunum, colon, and duodenum (13). In our study, the mean stone size was 26 mm (55-16 mm) and obstruction involved ileojejunal region in 3 patients, proximal jejunum in 1 patient, and the ileocecal valve in 1 patient.

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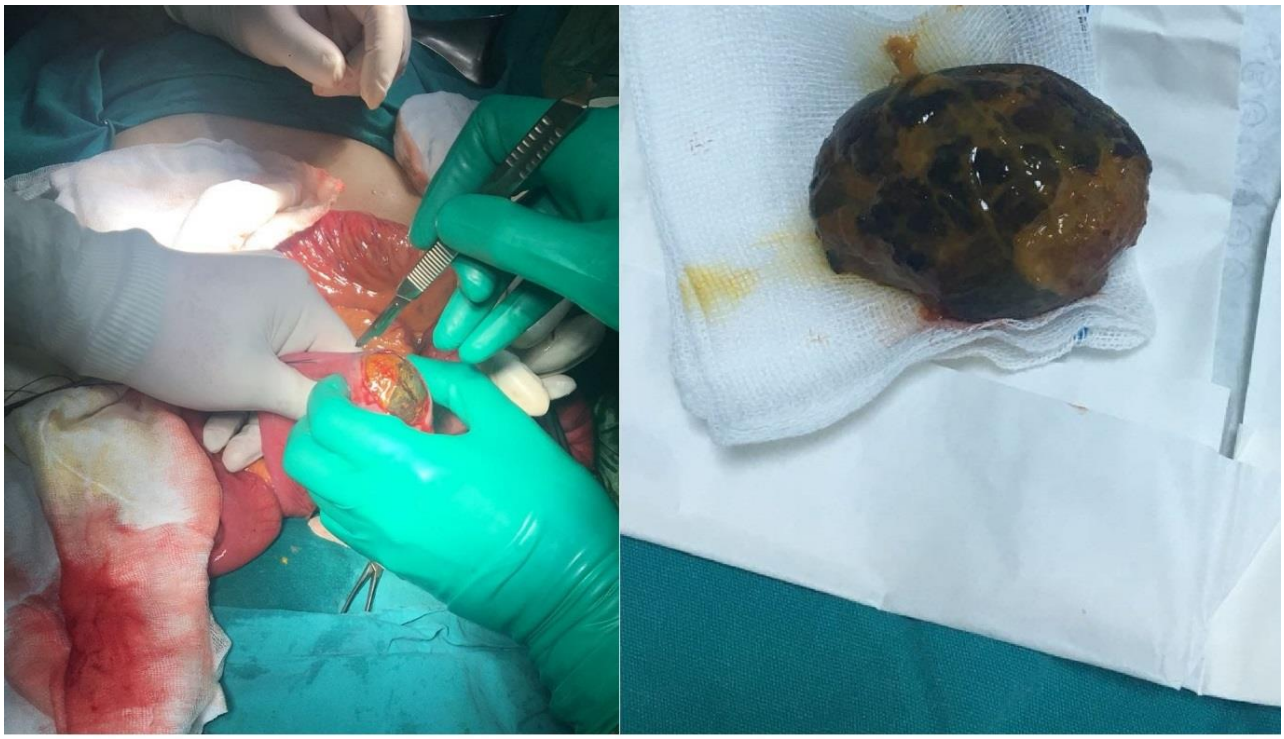

Figure 2: Surgical removal of gallstones causing intestinal obstruction.

The descending order of the frequencies of fistula locations are cholecystoduodenal (76%), cholecystocolic (11%), cholecystogastric (6%), choledocoduodenal (4%), and cholecystocholedocal (3%) (7). Considering the mechanism of fistula formation between the gallbladder and its anatomic neighbour and the passage of bile stones into the intestinal lumen with signs and symptoms of intestinal obstruction, it is unsurprising that the most common type of fistula is the cholecystoduodenal type. In our study, all fistulae were between the gallbladder and the duodenum.

Signs and symptoms of GSI are not necessarily acute but may also occur on a subacute or chronic basis. Periodical attacks of abdominal pain due to passage of bile stones, followed by painless intervals, also known as the Karewsky Syndrome, have been defined in cases of chronic GSI (14). In all of these cases, an untreated bilioenteric fistula accompanying bile stones existed and all patients had an acute onset of clinical signs.

Endoscopy is another diagnostic technique which is usually used for the GSI patients. Detecting the gastric or duedonal bilioenteric fistulaes by endoscopy contributes the diagnosis (15). Additionally, colonoscopy may be used for the treatment of stones which stay at the sigmoid colon (16). In the gallstone ileus patient group, the necessity and timing of treatment of fistulae and gallbladder stones remain as uncertain as the method to be used for the treatment. However, the treatment of residual stones with minimally invasive methods such as endoscopy seems to be less aggressive than complex surgical methods.

The retrospective design and the small number of patients are the main limitations of the study.

Although GSI is one of the rare causes of intestinal obstruction, it should be remembered in patients with advanced age and a history of cholelithiasis who present with signs and symptoms of intestinal obstruction.

Funding: This study was not supported financially by any person or institution.

Conflict of Interest: The author declare that they have no conflict of interest.

KÜ Tıp Fak Derg 2019;21(3):353-358
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***Ethical Approval*:** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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