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담낭 절제술을 받은 환자의 담즙 감염과 관련인자에 대한 고찰

Incidence of bactibilia and related factors in patients who undergo cholecystectomy

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서울대학교 대학원

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Abstract

Incidence of bactibilia and related factors in patients who undergo cholecystectomy

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Background: In general, bile is normally sterile. However, there are reports bactibilia may occur in certain instances, but the causal factors are unclear. We analyzed possible preoperative predictors of bactibilia upon cholecystectomy.

Methods: Bile samples were collected during cholecystectomies from November 2018 to November 2019. A total of 428 open or laparoscopic cholecystectomies were performed. Preoperative, intraoperative, and postoperative variables were compared between the culture–positive and culture–negative groups.

Results: In total, 157 (36.7%) patients were culture–positive. Gram–negative bacteria (95, 61.0%) were more common. Escherichia coli (38, 40%) and Enterobacter (22, 23.2%) were the most common species. In culture–positive patients, who were aged ≥70 years (58.4% vs. 41.6%, $p < 0.001$) and with fever

(58.7% vs. 41.3%, $p < 0.001$) were more vulnerable to bactibilia. Culture-positive patients more frequently underwent preoperative procedures, including endoscopic retrograde cholangiopancreatography (ERCP; 75.0% vs. 25.0%, $p < 0.001$) and percutaneous transhepatic gallbladder drainage (PTGBD; 63.1% vs. 36.9%, $p < 0.001$) than culture-negative patients. In multivariate analysis, age ≥70 years (hazard ratio [HR]: 2.874, 95% confidence interval [CI]: 1.769–4.670, $p = 0.001$), abdominal pain (HR: 1.730, 95% CI: 1.026–2.919, $p = 0.040$), ERCP (HR: 9.001, 95% CI: 4.833–16.75, $p < 0.001$), and PTGBD (HR: 2.866, 95% CI: 1.440–4.901, $p = 0.002$) were independent risk factors for bactibilia.

Conclusions: Among patients who underwent cholecystectomy, those who were elderly, symptomatic, and underwent preoperative drainage were more likely to have bactibilia. In such cases, surgeons should take care to prevent bile leakage during surgery and consider administering appropriate antibiotics.

Keywords : Gallbladder, Bactibilia, Cholecystectomy, Antibiotics
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I. Introduction

Bile is a complex aqueous secretion that originates from hepatocytes.[1] It is modified by absorptive and secretory transport systems in the bile duct epithelium and eventually enters the gallbladder (GB), where it is concentrated or delivered directly to the intestinal lumen.[2] After entering the intestinal lumen, bile is excreted in feces or returned to the liver through the portal vein.[3,4] Throughout this process, bile is typically sterile.[5,6]

However, bacteria can start to grow in bile under several conditions, and this is called bactibilia.[7,8] Bactibilia can cause severe inflammatory conditions such as cholecystitis, cholangitis, and sepsis. Therefore, it is very important to determine the epidemiology of bactibilia and to elucidate risk factors related to its occurrence, in order to predict and improve the clinical outcomes of patients.[7,9] Several factors, including old age, previous endoscopic retrograde cholangiopancreatography (ERCP), and acute cholecystitis, have been identified as risk factors for bactibilia.[6,10,11] However, microbiology may differ between areas and hospitals (i.e., community hospital vs. tertiary referral hospital); therefore, it is necessary to investigate this issue at different regions or institutions.[12–14] The present study aimed to identify the causative microorganisms and preoperative risk factors for bactibilia in a community hospital in South Korea.

II. Methods

This was a retrospective cohort study using prospectively collected medical data. Between November 2018 and November 2019, 463 patients underwent open or laparoscopic cholecystectomies for benign GB disease at our institution. Among them, 35 patients were excluded because they underwent other operations in addition to cholecystectomy or did not consent to be included in this study. Thus, 428 patients were included in this study. Two experienced hepatobiliary surgeons performed cholecystectomies throughout the study period. This study was approved by the Institutional Review Board of Seoul Metropolitan Government-Seoul National University Boramae Medical Center, Seoul, Korea, and all patients provided written informed consent to participate in this study (IRB No. 20-2018-79).

Patients' medical data were prospectively collected. Basic clinical variables, such as sex, age, American Society of Anesthesiologists (ASA) score, and chief complaints (e.g., abdominal pain, fever, and jaundice), were investigated. Comorbidities such as diabetes mellitus and hypertension were also analyzed. Preoperative radiologic findings were also investigated to identify GB stones, common bile duct (CBD) stones, CBD dilatation, and cholangiohepatitis. In addition, the performance of preoperative procedures was analyzed, and bile culture results during cholecystectomy were collected. All patients underwent preoperative computed tomography using Elite 128 (Philips Medical Systems, Cleveland, OH, USA), Ingenuity 128 (Philips Medical Systems), or Revolution (GE, Windsor, CT, USA).

A second-generation cephalosporin antibiotic was intravenously administered prior to elective surgery, while a third-generation cephalosporin antibiotic and metronidazole were administered in emergency surgery. When the patient’ s vital signs were unstable due to severe cholecystitis, or preoperative evaluation was necessary due to underlying comorbidities, percutaneous transhepatic GB drainage (PTGBD) was inserted, and elective surgery was performed after the patient’ s condition had stabilized and preoperative evaluation had been completed. Additionally, ERCP was performed when the CBD was occluded by stones, and endoscopic retrograde biliary drainage was also inserted simultaneously.

Bile samples were collected aseptically at the time of surgery by swabs. For laparoscopic cholecystectomy, the first step was ligation of the cystic artery and cystic duct. Then, the GB was carefully separated from the liver, placed in a LapBag (Sejong Medical Co., Paju-si Korea), and removed from the umbilicus. The swab was taken by creating a hole in the GB inside the bag before removing it through the umbilicus. In the case of open cholecystectomy, the GB was punctured upon its removal, and a swab was taken. Cotton swabs (COPAN, Brescia, Italy) were carefully evaluated for aerobic, anaerobic, and fungal organisms by routine cultivation for 48 h at 35℃ in 5% carbon dioxide in BAP and MacConkey agar.

The Chi-square test and Fisher’ s exact test were used to evaluate qualitative data. The Student’ s t-test and Mann-Whitney U test were used to quantitatively compare two groups. Logistic regression was used for multivariate analysis. All statistical analyses were performed using SPSS version 25.0 (IBM SPSS Statistics, IBM Corp., Armonk, NY, USA). Statistical significance was set at $p < 0.05$.

III. Results

Detailed clinicopathologic findings of the patients are described in Table 1. In total, 157 (36.7%) patients had positive bile culture results. The mean age of patients was 59.2 ± 16.5 years (range: 20–96 years). In total, 306 (71.5%) patients had abdominal pain, 104 (24.3%) patients had a preoperative fever higher than 38℃, and 16 (3.7%) patients had jaundice. 58 (13.6%) patients had an ASA score of 3 or 4. 137 (32.0%) patients underwent preoperative procedures, 72 (16.8%) patients underwent ERCP and 65 (15.2%) patients underwent PTGBD.

Culture−positive patients were older (age ≥70 years, $p < 0.001$) and more frequently male [101 (41.9%) vs. 56 (26.9%), $p < 0.001$] than culture−negative patients. Culture−positive patients also had preoperative fever (>38.0℃) significantly more frequently than culture−negative patients [61 (58.7%) vs. 43 (41.3%), $p < 0.001$)]. The rate of preoperative drainage insertion was higher in culture−positive patients than in culture−negative patients. Among preoperative radiologic variables, the percentages of patients with CBD stones [58 (36.9%), $p < 0.001$] and cholangiohepatitis [34 (21.7%), $p < 0.001$] were significantly higher in the culture−positive group than in the culture−negative group. The Tokyo Guideline grades of patients also significantly differed between the two groups ($p = 0.008$)[15]. Several preoperative laboratory findings differed significantly between the two groups. The percentages of patients with leukocytosis [white blood cell count ≥11,000 μl; 63 (40.1%) vs. 45 (16.6%), $p < 0.001$], total bilirubin level ≥2.5 mg/dL [46 (29.3%) vs. 21 (7.7%), $p < 0.001$], and c−reactive protein level ≥5.0 mg/dL [60 (38.2%) vs. 38 (14.0%), $p < 0.001$]

were significantly higher in the culture-positive group than in the culture-negative group.

In multivariate analysis, age ≥70 years (hazard ratio [HR]: 2.874, 95% confidence interval [CI]: 1.769–4.670, p = 0.001), male sex (HR: 1.744, 95% CI: 1.114–2.755, p = 0.018), abdominal pain (HR: 1.730, 95% CI: 1.026–2.919, p = 0.040), PTGBD (HR: 2.866, 95% CI: 1.440–4.901, p = 0.002), and ERCP (HR: 9.001, 95% CI: 4.833–16.75, p < 0.001) were independent risk factors for bactibilia (Table 2).

When we analyzed only for those who visited emergency room with GB stone, 80 (55.9%) of 143 patients had bactibilia. In univariate analysis, patients with age ≥70 years (67.2% vs. 32.8%, p=0.012), with hypertension (53.8% vs. 36.5%, p=0.044), and patients who underwent preoperative procedures (p=0.002) were identified as a risk factors for bactibilia. (Table 3) Preoperative procedures such as PTGBD (HR: 2.918, 95% CI: 1.172–7.265, p = 0.021), and ERCP (HR: 4.227, 95% CI: 1.751–10.204, p =0. 0.001) were identified as the only independent risk factors for bactibilia. (Table 4)

Perioperative factors were also investigated. The most commonly used antibiotic was cefotetan (219, 51.2%), followed by ceftriaxone with metronidazole (97, 22.7%), ceftriaxone (51, 11.9%), piperacillin-tazobactam (35, 8.2%), moxifloxacin (23, 5.4%), and meropenem (three, 0.7%). Culture-positive patients had a longer operation time (52.0 ± 38.1 minutes vs. 40.3 ± 30.0 minutes, p < 0.001), a higher open conversion rate [eight (5.1%) vs. four (1.4%), p = 0.029], longer overall hospitalization (12.08 ± 10.97 days vs. 7.26 ± 6.63 days, p < 0.001), a longer postoperative hospital stay

(7.11 ± 8.52 days vs. 4.58 ± 4.77 days, $p < 0.001$), and longer antibiotic administration (9.04 ± 8.98 days vs. 4.04 ± 5.63 days, $p < 0.001$) than culture-negative patients. However, the percentages of patients with postoperative complications [24 (15.3%) vs. 26 (9.6%), $p = 0.055$] including overall infectious complications [seven (4.6%) vs. six (2.2%), $p = 0.078$] and surgical site infection [seven (4.6%) vs. four (1.5%), $p = 0.055$] did not significantly differ between the two groups.

Among the 157 positive culture tests, Gram-positive bacteria were detected in 61 (38.9%) patients, and Gram-negative bacteria were detected in 95 (61.1%) patients. Among Gram-positive bacteria, *Enterococcus species* was the most common (43, 70.5%), followed by *Streptococcus species* (14, 23%) and *Staphylococcus species* (4, 6.5%). Among Gram-negative bacteria, *Escherichia coli* was the most common (38, 40.0%), followed by *Enterobacter species* (22, 23.2%). *Klebsiella pneumonia*, *Citrobacter freundii*, *Raoultella planticola*, *Klebsiella oxytoca*, *Citrobacter farmeri*, *Ochrobactrum intermedium*, *Escherichia fergusonii*, *Citrobacter koseri*, *Hafnia alvei*, and *Pantoea species* were also identified. (Table 5)

Among 137 patients who underwent preoperative procedures, 95 (69.3%) patients had positive culture results. (Table 5) Among these patients, Gram-positive bacteria were detected in 46 (48.4%) patients, and Gram-negative bacteria were detected in 49 (51.6%) patients. Among patients who did not undergo preoperative procedures, Gram-negative bacteria were more commonly identified than Gram-positive bacteria [46 (75.8%) vs. 15 (24.2%)]. Gram-positive bacteria were more commonly identified in patients who underwent ERCP than in patients who underwent PTGBD and patients who did not undergo preoperative procedures [35 (64.8%) vs. 11 (26.8%), $p < 0.001$; and 35 (64.8%) vs. 15 (24.2%), $p < 0.001$, respectively]. However, Gram-negative bacteria were more commonly identified in patients who underwent PTGBD, but there was no significant difference from patients who did not undergo preoperative procedures [30 (73.2%) vs. 46 (75.8%), $p = 0.799$].

IV. Discussion

In our study, we found a relationship between old age and bactibilia. We found that age older than 70 years was a risk factor for bactibilia (HR: 2.874, p = 0.001) and it was consistent with other previous studies.[11,16,17] Based on several reports that human immunity decreases with aging, which increases susceptibility to infection, old age can be considered a risk factor for bactibilia.[18,19] Male sex was also a risk factor for bactibilia in our study (HR: 1.744, p = 0.018). Maseda et al. reported that male gender is a significant risk factor for bactibilia.[20] Conversely, Galili et al. and other investigators concluded that gender is not a significant factor for culture outcomes.[7,10] Given these conflicting results, a study with more patients is required to obtain a more reliable conclusion.

In our study, among patients who underwent preoperative PTGBD, two-thirds had positive culture results, and Gram-negative bacteria were detected in three-quarters of these patients, which is in line with previous studies.[21-23] The possibility of an ascending infection due to PTGBD cannot be excluded. However, given that the distribution of strains was similar in patients who underwent PTGBD and those who did not undergo preoperative procedures, it is reasonable to assume that these bacteria are a causative factor of acute cholecystitis. (Table 5)

In our study, preoperative ERCP was a major risk factor for bactibilia. Gram-positive bacteria accounted for about two-thirds of positive results, and *Enterococcus* species were most commonly identified. Sghir et al.[24] reported that *Enterococcus* species are detected in normal bowel contents of humans, and several studies have demonstrated that preoperative ERCP is a risk factor for bactibilia.[5,11,25] Considering that the bacterial distribution of patients who underwent ERCP differed from that of patients who did not undergo preoperative procedures in the present study, bactibilia may have resulted from an ascending infection of the bowels. (Table 5) Many studies have suggested that an ascending infection of the bile duct starting from the duodenum due to sphincterotomy can be responsible for positive culture results after preoperative ERCP.[11,25,26] When sphincterotomy is performed, the pressure of the bile duct decreases, resulting in retrograde flow of the bowel' s contents.[27,28] In addition, Ruan et al. suggested that ERCP destroys the normal anatomy of the bile tract and increases bile reflux due to biliary tract motor dysfunction.[29] As bile reflux increases, inflammatory edema may occur in the bile mucosa, which ultimately creates an environment favorable for bacterial growth and colonization.

On the contrary to the present study, there have been several studies that gram-negative bacteria were identified more frequently than gram-positive bacteria for the patients who underwent ERCP. [30,31] However, among gram-negative bacteria, the most commonly identified microorganisms were varied from institutions. Manrai et al. has been reported that *E.coli* was the most common, and Earnshaw et al. and Bass et al. reported that *Pseudomonas* was the most common gram-negative bacteria.[5,32,33] Du et al. and Basioukas et al. reported that *Enterococcus* was the most commonly identified bacteria in the patients underwent ERCP, which is in line with the present study.[34,35] These differences might be resulted from variance in the distribution of bacteria according to regions or hospitals, however, the exact reasons have not clarified yet and further large−scale studies from various institutions in different regions are mandatory.

Various bacteria, including Gram−positive and Gram−negative bacteria, and even a fungus, were identified [Gram−positive, 61 (38.9%) and Gram−negative, 95 (60.5%)]. Many other studies described a higher portion of Gram−negative bacteria (66.2–75.9%).[23,36,37] However, in the study by Rupp et al., which was conducted at a tertiary hospital in Germany, Gram−positive bacteria were identified in 840 (57%) patients, and Gram−negative bacteria were identified in 651 (43%) patients.[38] These differences in microorganisms present in bile might be due to regional or institutional differences. Therefore, clinicians should understand these variations in terms of epidemiology to choose the optimal antibiotics and improve the clinical outcomes of patients.[12,13]

The present study showed that the operation time, open conversion rate, length of hospitalization, and length of antibiotic administration were higher among culture−positive patients than among culture−negative patients. However, there were no differences in postoperative complications including surgical site infection. Previous studies reported an association between operative complications and bactibilia.[9,11] For elucidating the relationship between bactibilia and postoperative complications, further large−scale multicenter studies should be needed.

This study has several limitations. First, there is a possibility of selection bias because the study was conducted at a single institution. However, this study provides information on the incidence of bactibilia and types of causative bacteria to clinicians working in community hospitals, where patients with gallstone−

related symptoms visit for the first time, so that clinicians can provide appropriate treatment. Second, it is possible that the frequency and categories of administered intravenous antibiotics differed between elective and emergency surgeries, which may have affected the bile culture results. However, in patients who did not undergo preoperative procedures, the average number of days of antibiotic use before surgery was 0.85 days, which may have been insufficient to reach the therapeutic dose of antibiotics. Lastly, there is a possibility of contamination during the PTGBD insertion, such as ascending infection of skin normal flora through the tube. However, the composition of bacteria in patients between PTGBD and no procedure was comparable (Table 3). Therefore, this study demonstrates that patients who undergo procedures prior to cholecystectomy have a high possibility of having bactibilia, and caution should be taken.

Bactibilia occurred in about one-third of patients and patients with male gender, older than age 70years, with abdominal symptom, and underwent pre-operative PTGBD or ERCP were likely to have bactibilia. Surgeons should keep in mind that bactibilia might exist in those patients and should take care during operation to avoid spillage of infected bile into the peritoneal cavity. Since the causative bacteria differs depending on the case of PTGBD or ERCP, it is necessary to use an antibiotic suitable for each case.

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Table 1. Demographics and clinicoradiologic features according to bile culture results

Parameter, n (%)	Total (N=428)	Culture (−) (N = 271)	Culture (+) (N = 157)	p−value
Age (≥70 years, %)	149 (34.8%)	62 (41.6%)	87 (58.4%)	<0.001
Sex				<0.001
Male	220 (51.4%)	119 (54.1%)	101 (41.9%)	
Female	208 (48.6%)	152 (73.1%)	56 (26.9%)	
ASA score				0.001
1 or 2	370 (86.4%)	246 (66.5%)	124 (33.5%)	
3 or 4	58 (13.6%)	25 (43.1%)	33 (56.9%)	
DM	81 (18.9%)	39 (48.1%)	42 (51.9%)	0.002
HTN	156 (36.4%)	79 (50.6%)	77 (49.4%)	<0.001
Abdominal pain	306 (71.5%)	181 (59.2%)	125 (40.8%)	<0.001
Fever (>38.0° C)	104 (24.3%)	43 (41.3%)	61 (58.7%)	<0.001
Jaundice	16 (3.7%)	5 (31.3%)	11 (68.8%)	0.007
Hospitalization route				<0.001
Outpatient clinic	240 (56.1%)	182 (75.8%)	58 (24.2%)	
Emergency room	188 (43.9%)	89 (47.3%)	99 (52.7%)	
Tokyo Guideline grade				0.008
0 and A	362 (84.6%)	239 (66.0%)	123 (34.0%)	
B and C	66 (15.4%)	32 (48.5%)	34 (51.5%)	
Preoperative procedures				<0.001
None	291 (68.0%)	229 (78.7%)	62 (22.3%)	
PTGBD	65 (15.2%)	24 (36.9%)	41 (63.1%)	
ERCP	72 (16.8%)	18 (25.0%)	54 (75.0%)	

ASA, American Society of Anesthesiologists; DM, Diabetes Mellitus; HTN, Hypertension; PTGBD, percutaneous transhepatic gallbladder drainage; ERCP, endoscopic retrograde cholangiopancreatography.

Table 2. Independent risk factors for bactibilia in univariate and multivariate analysis

Variable	Univariate		Multivariate		
	HR	p-value	HR	95% CI	p-value
Age (≥70 years)	1.469	<0.001	2.874	1.769–4.670	0.001
Male sex	1.724	<0.001	1.744	1.114–2.755	0.018
Abdominal pain	1.712	<0.001	1.730	1.026–2.919	0.040
Fever (>38.0° C)	1.467	<0.001	1.29	0.74–2.27	0.322
Jaundice	3.143	0.007	2.349	0.839–6.573	0.104
DM	2.173	0.002	1.457	0.775−2.457	0.262
HTN	2.339	0.001	1.388	0.831−2.318	0.250
Hospitalization route: emergency room	3.214	<0.001	0.816	0.468–1.422	0.473
ASA score (≥3)	2.328	0.002	1.583	0.832–3.011	0.162
Tokyo Guideline B and C	2.065	0.008	1.437	0.752–2.749	0.273
Preoperative procedures					
PTGBD	5.059	<0.001	2.866	1.440–4.901	0.002
ERCP	14.058	<0.001	9.001	4.833–16.75	<0.001

ASA, American Society of Anesthesiologists; DM, Diabetes Mellitus; HTN, Hypertension; PTGBD, percutaneous transhepatic gallbladder drainage; ERCP, endoscopic retrograde cholangiopancreatography.

Table 3. Demographics and clinical features according to bile culture results in patients refered from emergency room with GB stone

Parameter, n (%)	Total (N=143)	Culture (−) (N = 63)	Culture (+) (N = 80)	p−value
Age (≥70 years, %)	67 (46.9%)	22 (32.8%)	45 (67.2%)	0.012
Sex, no. (%)				0.056
Male	92 (64.3%)	35 (38.0%)	57 (62.0%)	
Female	51 (35.7%)	28 (54.9%)	23 (45.1%)	
DM, no. (%)	35 (24.5%)	14 (40.0%)	21 (60.0%)	0.696
HTN, no. (%)	66 (46.2%)	23 (36.5%)	43 (53.8%)	0.044
ASA score, no. (%)				0.218
1, 2	113 (79.0%)	53 (46.9%)	60 (53.1%)	
3, 4	30 (21.0%)	10 (33.3%)	20 (66.7%)	
Abdominal pain, no. (%)	131 (91.6%)	57 (43.5%)	74 (56.5%)	0.765
Fever (≥37.5℃), no. (%)	70 (49.0%)	25 (35.7%)	45 (64.3%)	0.064
Jaundice, no. (%)	6 (4.2%)	2 (33.3%)	4 (66.7%)	0.694
Tokyo Guideline grade				0.509
0 and A	119 (83.2%)	54 (45.4%)	65 (54.6%)	
B and C	24 (16.8%)	9 (37.5%)	15 (62.5%)	
Pre−operative procedure, no. (%)				0.002
None	61 (42.6%)	37 (60.7%)	24 (39.3%)	
PTGBD	37 (25.9%)	12 (32.4%)	25 (67.6%)	
ERCP	45 (31.5%)	14 (31.1%)	31 (68.9%)	

ASA, American Society of Anesthesiologists; DM, Diabetes Mellitus; HTN, Hypertension; PTGBD, percutaneous transhepatic gallbladder drainage; ERCP, endoscopic retrograde cholangiopancreatography.

Table 4. Independent risk factors for bactibilia in univariate and multivariate analysis in patients refered from emergency room with GB stone

Variable	Univariate		Multivariate		
	HR	*p*-value	HR	95% CI	*p*-value
AGE(≥70)	2.396	0.012	1.555	0.681 – 3.548	0.294
Sex – Male	1.983	0.053	2.139	0.999 – 4.581	0.050
Fever(≥37.5)	1.954	0.050	1.339	0.632 – 2.833	0.446
Hypertension	2.021	0.041	2.139	0.999 – 4.581	0.063
Preoperative procedures					
PTGBD	3.212	0.008	2.918	1.172 – 7.265	0.021
ERCP	3.141	0.003	4.227	1.751 – 10.204	0.001

ASA, American Society of Anesthesiologists; DM, Diabetes Mellitus; HTN, Hypertension; PTGBD, percutaneous transhepatic gallbladder drainage; ERCP, endoscopic retrograde cholangiopancreatography.

Table 5. Bacteria in culture−positive bile

Species	Total (N = 157)	Preoperative procedure (N = 95)		No procedure[c] (N = 62)
		PTGBD[a*] (N = 41)	ERCP[b] (N = 54)	
Gram−positive, n (%)	61 (38.9%)	11 (26.8%)	35 (64.8%)	15 (24.2%)
Enterococcus species	43	7	27	9
Streptococcus species	14	2	6	6
Staphylococcus species	4	2	2	0
Gram−negative, n (%)	95 (61.0%)	30 (73.2%)	19 (35.2%)	46 (75.7%)
Escherichia coli	38	13	5	20
Enterobacter species	22	4	5	13
Klebsiella pneumonia	20	8	6	6
Citrobacter freundii	4	1	1	2
Raoultella planticola	3	1	0	2
Klebsiella oxytoca	2	2	0	0
Citrobacter farmeri	1	0	1	0
Ochrobactrum intermedium	1	0	1	0
Escherichia fergusonii	1	1	0	0
Citrobacter koseri	1	0	0	1
Hafnia alvei	1	0	0	1
Pantoea species	1	0	0	1
Fungus	1 (0.1%)	0	0	1 (0.1%)

*a vs. b: <0.001 ; b vs. c: <0.001 ; a vs. c: 0.799

국문초록

담낭 절제술을 받은 환자의 담즙 감염과 관련인자에 대한 고찰

배경: 일반적으로 담즙은 일반적으로 무균 상태이다. 그러나 경우에 따라 세균이 발생할 수 있다는 보고가 있으나 원인이 불분명하다. 우리는 담낭 절제술 시 세균의 가능한 수술 전 예측 인자를 분석했다.

방법 : 2018년 11월부터 2019년 11월까지 담낭절제술 동안 담즙 검체를 채취하였다. 총 428건의 개방 또는 복강경 담낭절제술을 시행하였다. 수술 전, 수술 중, 수술 후 변수를 배양 양성 그룹과 배양 음성 그룹에서 비교하였다.

결과 : 총 157명(36.7%)의 환자가 배양 양성이었다. 그람음성균(95, 61.0%)이 더 많았으며, 대장균(38, 40%)과 장내세균총(22, 23.2%)이 가장 흔한 종이었다. 단변량 분석에서 70세 이상($p<0.001$), 남성($p<0.001$), 미국마취학회 신체상태분류 점수가 높은 환자($p=0.001$), 당뇨병($p=0.002$), 고혈압($p<0.001$), 복통 ($p<0.001$), 발열($p<0.001$), 황달($p=0.007$), 높은 도쿄 가이드라인 등급($p=0.008$), 경피적 경간 담낭 배액($p<0.001$), 내시경 역행성 담췌관 조영술($p<0.001$)이 확인되었다. 세균의 위험인자로. 다변량 분석에서 연령 ≥70세(위험비[HR]: 2.874, 95% 신뢰 구간[CI]: 1.769-4.670, $p = 0.001$), 복통(HR: 1.730, 95% CI: 1.026-2.919, $p = 0.040$), ERCP(HR: 9.001, 95% CI: 4.833-16.75, $p < 0.001$) 및 PTGBD(HR: 2.866, 95% CI: 1.440-4.901, bact에 대한 $p = 0.002$)는 독립적인 위험인자였다.

결론 : 담낭절제술을 시행한 환자 중 고령자, 증상이 있는 환자, 술 전 배액술을 받은 환자에서 세균이 있을 가능성이 더 높았다. 이러한 경우 외과의는 수술 중 담즙 누출을 방지하고 적절한 항생제 투여를 고려해야 한다.

주요어 : 담낭, 세균, 담낭절제술, 항생제
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