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Diagnosis of Bacterial Association of Gall bladder Infection and Antibiotic Sensitivity

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Abstract

An essential component of the human digestive system is the gallbladder. Its main purpose is to retain bile salts and acids, which act as surfactants on dietary fats and oils during the digestive process. It is situated beneath the liver. Between October 2023 and June 2024, 50 tissue samples from individuals ranging in age from 15 to 71 years old were obtained for the study at Al. Hilla Teaching Hospital. The study involved using the Vitak 2 Compact System to diagnose antibiotic sensitivity and isolating bacteria from tissue. Gram-negative bacteria were most prevalent in Escherichia coli, accounting for 30% of the total, followed by Ochrobactrum anthropi (12%) and Klebsiella pneumoniae. (10%), Enterobacter aerogenes (8%), and Enterobacter cloacae (8%). The Enterococcus faecalis constituted 16% of the Gram-positive bacteria, while Enterococcus gallinarum made up 16%. The results of the antibiotic test showed that 100% of the Gram-positive bacteria were sensitive to ampiciline and tigecycline, whereas all of the bacteria exhibited resistance to cefazolin.

Key word*: Gall bladder, Bacterial diagnosis, Antibiotic sensitivity*

Introduction

In Western nations, the most common abdominal surgery is a cholecystectomy. For over a century, until Philippe Mouret's pioneering work in 1987, cholecystectomy was typically performed using an open approach (Carl Langenbuch performed the first successful cholecystectomy in 1882). Currently, the preferred way for treating cholecystitis is the laparoscopic technique [1]. The composition of the gut microbiota is significantly altered following cholecystectomy [2]. Following cholecystectomy, the actual number of taxa decreases even more sharply in comparison to those without GSD ,conversely, the number of Bifidobacterium and Anaerostipes Dorea increases (Wang et al., 2018). An increase in the Firmicutes species B. obeum and V. Parvula in certain individuals [2,3].

Enterococcus, Fusobacterium, and Shigella are microorganisms found in the duodenum and bile duct that belong to the same genus, Escherichia [4]. Given that the duodenal papilla connects the bile duct physically to the gastrointestinal tract, the theory postulates that the biliary microbiota migrates retrogradely from intestinal microorganisms into the biliary channel. Evidence pointing to similarities in the duodenum and biliary microbiota's compositions supports the theory. Furthermore, 16S sequencing allowed for the identification of the whole community of bacteria discovered in the bile of the upper gastrointestinal tract [5] While the intestine microbiome is less common than that of the respiratory tract and oral cavity, it is interesting that in patients with cholelithiasis, the intestinal

microbiome adds to the heterogeneity of the biliary microbiome [6]. Researchers studied the composition of microorganisms associated with cholelithiasis because biliary microbiome and metabolic illness interact. A Colombian investigation [7] revealed that Pseudomonas spp. was prominent in bile and gallbladder tissue. Aim of this study isolation of bacteria and diagnosis by vitek 2 system and study of antibiotic sensitivity of bacteria.

Materials and methods

Fifty patients (ages 20 to 66) undergoing breast surgery at AL-Hilla Teaching Hospital in Babylon Province provided samples of their gallbladder tissue between November 2023 and May 2024. After obtaining tissue for analysis, the fresh tissue was sliced and homogenized within 30 minutes of collection using a sterile surgical knife and wooden sticks. It was then placed in a sterilized plane tube or pee cup with a standard saline solution.Two media were used for cultivation: blood agar and MacConkey, followed by selective media.The bacteria were identified using a microscope, biochemical test in accordance with MacFadden's 2000 methodology, and the antibiotic sensitivity of the bacteria was verified using the Vitec 2Compact System.

Ethical approval

The Scientific Research Ethics Committee approved all techniques used in this study involving human subjects, while the Ministry of Health and mohser of Iraq provided ethical permission.

Result

According to the present study, the percentage of infections in women is obviously rising, standing at 56%, while infections in men are at 44%. Figures (1) and (2) illustrate that the age group (53–71 years) had the greatest infection rate (40%) and the group (34–52 years) had the lowest infection rates (26%)

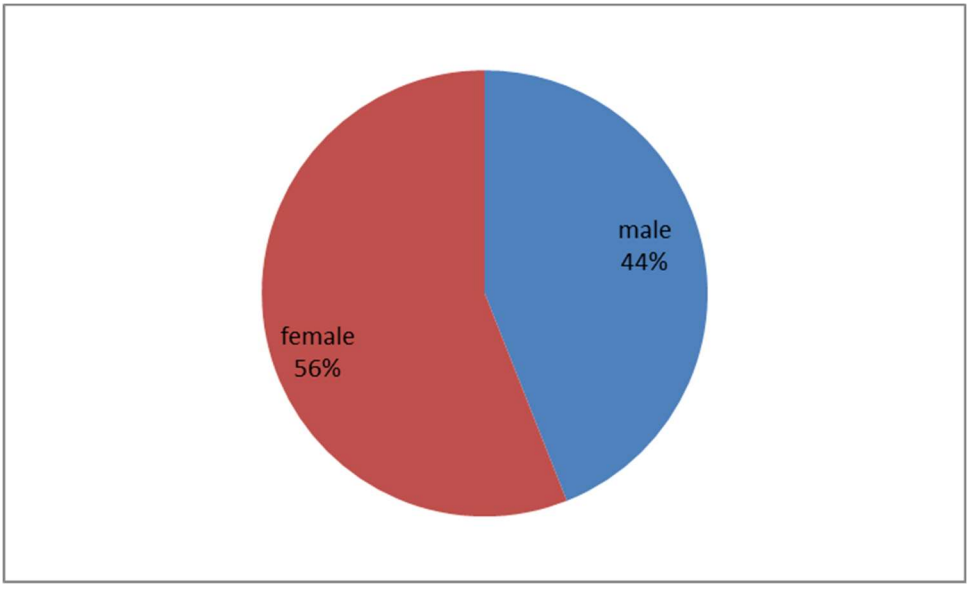

Figure (1) percentage of infection according to gender

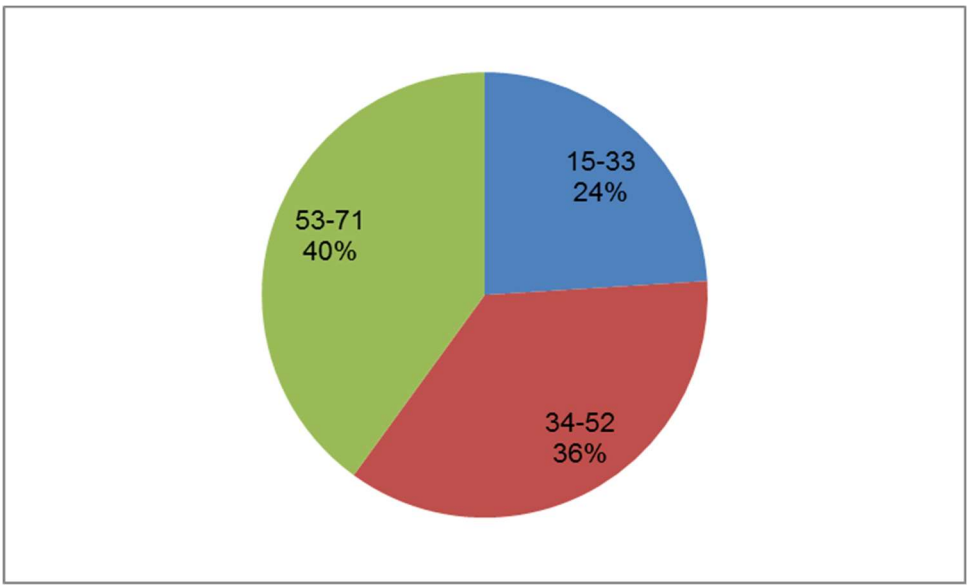

Figure (2) percentage of infection according to age groups

The outcomes of culturing isolated portions of gallbladder tissue revealed that.Escherichia coli led the group of bacteria isolated from the tissue gallbladder, accounting for 30% of all bacteria. Ochrobactrum anthropi, 12%), *Klebsiella pneumoniae*, 10%, *Enterobacter cloacae*, and 8% were the next highest percentages of Gram-negative bacteria. The results showed the heterogeneity of bacterial species. In table (1), *Enterococcus faecalis* accounted for 16% of the Gram-positive bacteria, while *Enterococcus gallinarum* made up 16%. What the current investigation found was. *Escherichia coli* was the predominant bacterial species found in the gallstone.

Table (1) types and probability of bacteria identify by VITEK 2

Bacteria	Number (percentage)	Probability
Klebsiella pneumoniae	5(10%)	99%
Escherichia coli	15(30%)	97%
Enterococcus faecalis	8(16%)	99%
Enterococcus gallinarum	8(16%)	98%
Enterobacter cloacae	4(8%)	99%
Enterobacter aerogenes	4(8%)	87%
Ochrobactrum anthropi	6(12%)	93%

The result of distribution of bacteria according to age groups show in table (2) *E. coli, K. pneumonia , E. cloacae* high percentage in age group (53-71) compare with other groups age

Table (2) distribution of bacteria according to age group

Bacteria	15-33 years	34-52 years	53-71years
Klebsiella pneumoniae	20%	20%	60%
Escherichia coli	20%	33%	47%
Enterococcus faecalis	25%	25%	50%
Enterococcus gallinarum	37%	38%	25%
Enterobacter cloacae	25%	25%	50%
Enterobacter aerogenes	25%	50%	25%
Ochrobactrum anthropi	17%	33%	50%

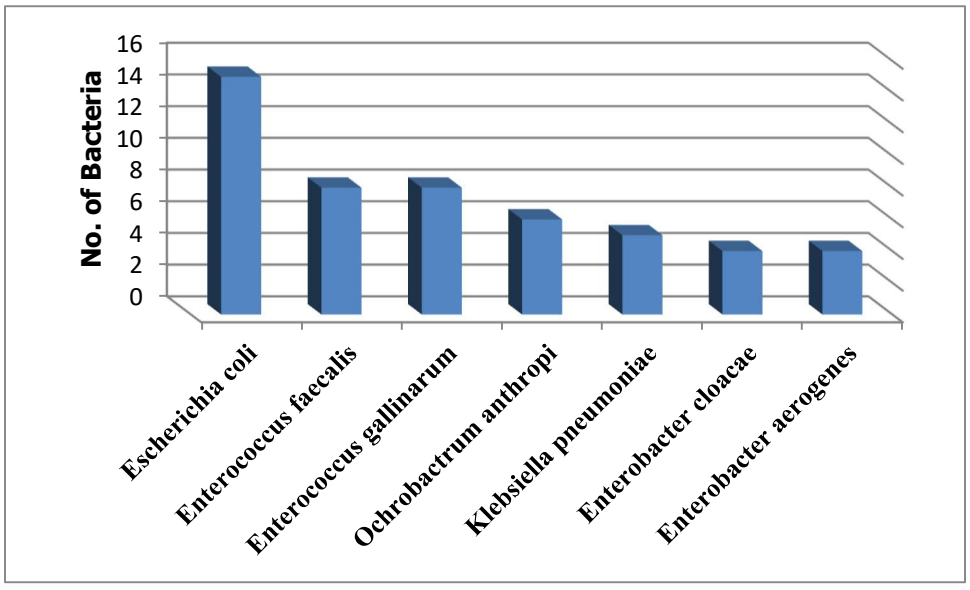

Figure (3) types of gram negative bacteria and gram positive

The result of distribution of bacteria according to gender (male and female) *E. coli* and *K. pneumonia* found in female high number than male figure (4)

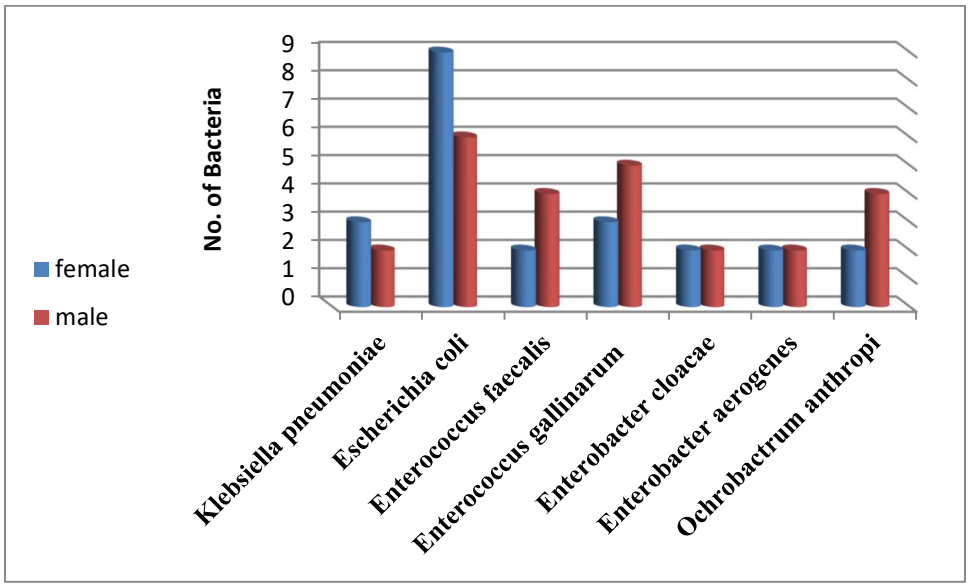

Figure (4) Distribution of bacteria according to gender

Antibiotic sensitivity

Based on the results of antibiotic susceptibility tests, three types of pathogens were developed: sensitive, intermediate resistant, and resistant. Pathogens from the latter two classes were considered in the investigation of resistance rates. Due to differences in the test strips, each patient's susceptibility test result was different. Though susceptible to ceftoxitine, ceftriazodime, cefepime, and ciprofloxacine, *E. coli* is resistant to several medicines, including amikacin, gentamicin, ceftriaxone, levofloxacin, piperacillin, and amoxicillin high level of antibiotic resistance to cefazolin, amoxicillin, cefoxitin, ceftazidime, and ceftriaxone was demonstrated by *Klebsiella pneumoniae*, despite their responsiveness to trimethoprim, tigecycline, imipenem, amikacin, and ertapenem. Many microbes are likewise resistant to the class of antibiotics displayed in table (2)

Table (2) Antibiotic susceptibility for bacteria

	O.anthropi	*E. aerogenes*	*E. cloacae*	*E. gallinarum*	*E. faecalis*	*E. coli*	*K. pneumoniae*
ESBL						+	+
Amoxicillin	R			S		R	R
Ampicillin	R			S	S	R	R
Piperacillin	R	S	S		S	R	S
Cefazolin	R	R	R			R	R
Cefoxitin	R	R	R			S	R
Ceftazidime	R	I	S		S	S	R
ceftriaxone	R	R	S		S	R	R
Cefepime	S	S	S			S	R
Ertapenem	S	S	S		S	S	S
Imipenem	S	S	S			S	S
Amikacin	I	S	S			S	S
Gentamicin	R	R	S	R		S	R
Ciprofloxacin	S	S	S	R		R	R
Tigecycline		I	S	S	s	I	S
Levofloxacin	S	S	S			R	I
Nitrofurantoin	R	S	S			S	I
Trimethoprim	R	R	S			S	S

ESBL = Extended spectrum beta lactamase

Discussion

The gallbladder is a sterile organ, but pathological conditions like tumors, gallstones, and

polyps prevent bile from flowing freely, which lets bacteria grow inside the organ and lead to cholestasis [8,9]. Biliary tract inflammation and, in extreme circumstances, sepsis can result from bacterial colonization. Blood and the duodenum are the primary origins of biliary tract infections [10]. This study contradicted findings from other studies [11], It showed that those aged 31 to 40 had higher gallbladder inflammation. The results of the current study demonstrated that gallbladder inflammation affects individuals of all ages, with the 53–71 age group experiencing the worst symptoms.

Following analysis of the data, it was discovered that out of the 50 bacterial isolates, 34 of them were Gram-negative bacteria and only 16 were Gram-positive. These outcomes are consistent with previous research [12 ,13], study shown that *Escherichia coli, Klebsiella species*, and *Enterobacter species* are the most prevalent Gram-negative bacteria associated with gallbladder infections. Furthermore, consistent with literature, our findings [14] found that, out of 60 individuals, 66% had tests that showed they had bacteria in their bile, gallbladder wall, or both. The most often found types of bacteria were gram negative ones.

Because the bacteria originate in the intestines and travel from there to the bile ducts, particularly when the gallbladder includes a stone, a significant percentage of Gram-negative bacteria are present. Furthermore, some bacterial species' resistance and colonization may be impacted by the co-administration of various medications and antibiotics [15]. The number of bacterial isolates in the current study varied from that of previous studies, but the results were consistent with one another [16] which is different from several previous research that suggested a large proportion of these isolates based on the sample size's variety or the microscopic microorganisms' resistance to antibacterial medications [17, 18].

According to the 2010 criteria established by the European Centre for Disease Prevention and Control Advisory Forum, resistance to one agent of at least three classes of antibiotics is considered multidrug resistance (MDR). But this description does not cover resistance to a necessary antibacterial agent or resistance that is innate [19]. Bile gets more concentrated because of the absorption and metabolism of cephalosporins and quinolones, which are commonly used to treat biliary tract infections [20, 21].

The range of activity of the antibiotic against common biliary infections and its pharmacokinetic properties (tissue distribution, hepatic/biliary excretion) determine how effective antibiotic therapy is in situations of acute cholecystitis or cholangitis [22]. The metabolites linked to cancer, chronic inflammation from a lingering infection, and the generation of specific toxins by bacteria have all been linked to transformation of the gallbladder epithelium [23].

Three types of bacterial antibiotic resistance mechanisms can be distinguished: targeting the antibiotic differently, changing or breaking down the antibiotic molecule, and using an elimination mechanism to prevent the antibiotic from binding to the target location. Furthermore, adaptation (absorption of resistant genes from the environment), conjugation (absorption of resistant genes between resistant bacterial strains), and transduction (transfer of resistant genes from bacteriophages) are the usual ways in which bacteria acquire resistance genes [24]. Every gram-positive bacterium was ampiciline ll and tigecycline sensitive, according to the current study. These results imply that the antibiotic regimen for biliary infections should consider patterns of resistance in addition to the

antibacterial spectrum of the medications. Medical professionals should routinely examine the bile samples obtained during cholecystectomy to monitor the pathogenic species and drug susceptibility. This will give precise guidelines for postoperative care in addition to providing information for the empirical use of antimicrobial drugs in the future.

E. coli and *K. pneumonia* have the CTX-M genotype, which is one of the major types of ESBL. This study discovered that bacteria that produce ESBL increase antibiotic resistance. Mobile genetic elements are important in the propagation of the ESBL gene among bacteria.

Conclusion

Gram-negative bacteria were most prevalent in *Escherichia coli*, accounting for 30% of the total, followed by *Ochrobactrum anthropi* (12%) and *Klebsiella pneumoniae*. (10%), *Enterobacter aerogenes* (8%), and *Enterobacter cloacae* (8%). The *Enterococcus faecalis* constituted 16% of the Gram-positive bacteria, while *Enterococcus gallinarum* made up 16%. The results of the antibiotic test showed that 100% of the Gram-positive bacteria were sensitive to ampiciline and tigecycline, whereas all the bacteria exhibited resistance to cefazolin.

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