Does the postoperative diagnosis correlate with the final pathologic diagnosis in cholecystectomy?

Clarissa Ramirez MD, MBA, Ahmed Abdalla MD, Alikhan Karimi MD, Jasmin Rahesh MBA, MS, Brianna Taylor BS, Hassan Ahmed MD, MRCSI, Muhammad Nazim MD

ABSTRACT

Physicians diagnose cholecystitis using a variety of clinical signs and imaging modalities. Diagnoses are routinely confirmed with the gold-standard histopathological examination of the excised gallbladder. This study examines the correlation between the postoperative clinical diagnosis and postoperative pathology report findings. The clinical diagnosis of acute cholecystitis had a sensitivity of 58.8%, specificity of 75.2%, positive predictive value of 53.1%, and negative predictive value of 79.2% when compared to the final pathologic diagnosis. The clinical diagnosis of chronic cholecystitis agreed with the pathologic diagnosis of chronic cholecystitis in 45 of 54 cases (83.3%) but did not agree in 8 of 54 acute cases (14.8%); a clinical diagnosis of "symptomatic cholelithiasis" was associated with pathologic diagnosis of acute cholecystitis in 85 of 388 cases (21.9%). There was a statistically significant relationship between the clinical diagnosis and final pathologic diagnosis (chi-squared >32.91, p-value <0.001). One incidental case of malignant neoplasm was found in a patient with gallstones. Surgeons made an accurate clinical diagnosis of acute cholecystitis in one third to one half of their surgical cases; they made an accurate clinical diagnosis of chronic cholecystitis 80% of the time and correctly diagnosed neoplasms in 3 out of 4 cases. These results suggest that the mismatch between the postoperative clinical diagnosis and postoperative pathology occurs frequently enough that pathologic assessment should occur routinely after cholecystectomy.

Keywords: acute cholecystitis, chronic cholecystitis, cholelithiasis, pathological diagnosis

INTRODUCTION

Cholecystitis can be diagnosed using several clinical signs and imaging modalities. Inflammatory changes in the gallbladder wall due to edema or calculous obstruction can be identified using ultrasound, hepatobiliary iminodiacetic acid (HIDA), or computed tomography (CT).[1] Sonographic findings of acute cholecystitis include the sonographic Murphy sign—pain elicited by the gallbladder probe, more painful over the gallbladder than anywhere else—as well as a thickened gallbladder wall (>4 mm), enlarged gallbladder (>8 cm long axis or 4 cm short axis), and accumulation of pericholecystic fluid.[2] Acute cholecystitis requires a prompt cholecystectomy and antibiotics in high-risk patients, whereas chronic cholecystitis can be managed with an elective cholecystectomy.[3] Laing et al. found that 34.6% of patients with acute right upper quadrant (RUQ) pain had acute cholecystitis, 32.7% had chronic cholecystitis, and 32.7% had a normal gallbladder.[4] The diagnoses in this study were confirmed by histopathological examination of the excised gallbladder, which is the gold standard.[4]

This study aims to find the correlation between primary clinical diagnosis (stated by the physician in a

Corresponding author: **Jasmin Rahesh**
Contact Information: Jasmin.Rahesh@ttuhsc.edu
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patient's operative note) and the diagnosis in the postoperative pathology report. Routine pathologic examination of the gallbladder may be useful in detecting polyps and other masses that would require additional postoperative care,[5] but it may increase costs without improving outcomes in a value-based care model.[6] Wrenn et al. found that routine histopathology showed incidental findings of gallbladder carcinoma (0.25%) and dysplasia (0.70%) in some cases.[7] These results would require changes in clinical management, but this low incidence suggests that investigation through selective pathology could potentially reduce costs.[7]

Because an estimated 25 million Americans have cholelithiasis, which can lead to acute cholecystitis, it is important to determine whether available clinical studies are sufficient to accurately determine the correct diagnosis.[8] More information on the relationship between the clinical diagnosis and the final pathologic diagnosis could help clinicians determine how many cases of acute cholecystitis are missed or misdiagnosed in the perioperative setting and potentially increase their clinical acumen.

Methods

The goal of this study was to compare the clinical diagnosis in patients undergoing cholecystectomy to the final diagnosis based on histopathological examination. To obtain the data set, electronic medical records (EMR) were acquired from the EMR system at Northwest Texas Hospital (NWT Hospital) in Amarillo, Texas. A secure data sheet was created by searching for CPT code 47562 (laparoscopic cholecystectomy w/o intraoperative cholangiogram [IOC]), 47563 (laparoscopic cholecystectomy w/IOC), 47600 (open cholecystectomy w/o IOC), and 47605 (open cholecystectomy w/IOC). This search recovered 1000 patients, ages 10 through 93, with a billing code for cholecystectomy between July 2016 and December 2018. This data sheet and other documents were stored on iRIS and edited by SharePoint, a HIPAA-compliant site, to protect all identifiable patient information.

Collected information included primary diagnosis, age, sex, height, weight, body mass index (BMI), race (including White, Black, American Indian, and Asian/Pacific Islander), ethnicity (Hispanic or non-Hispanic), gallbladder ultrasound results, laboratory tests on admission, including WBC count, total bilirubin, alkaline phosphatase, lipase, amylase, computed tomography (CT) scan report, hepatobiliary iminodiacetic acid (HIDA) scan report, magnetic resonance imaging (MRI) report, gallbladder pathology report, type of surgery (open, laparoscopic, robotic), and presentation of symptoms (typical or atypical).

Missing information was collected by chart review of the patients' records using CernerWorks EMR. Microsoft Excel was used to alphabetize and count the final diagnoses. The diagnoses differed in wording and specifiers, resulting in a need for broader categories. Patients were classified in two different ways. The first method had three major categories: acute cholecystitis, chronic cholecystitis & other diagnoses, and gallbladder neoplasia. Any non-acute pattern of cholecystitis, including symptomatic cholelithiasis, was put into the middle category along with other indications for surgery, including included gallstone pancreatitis, trauma, biliary dyskinesia, and others. The second method included more specific categorization: acute cholecystitis, chronic cholecystitis, cholelithiasis, other diagnoses, and gallbladder neoplasia. This second method separated the specific diagnosis of "chronic cholecystitis" from diagnoses like "symptomatic cholelithiasis." Again, "other diagnoses" included cholecystectomies that showed the primary diagnosis as gallstone pancreatitis, trauma, biliary dyskinesia, and others. R-studio was used for statistical analysis to run a Pearson's Chi-squared test.

Statistical Analyses

We determined the proportion of patients who had the diagnosis of acute cholecystitis and who also had a histopathology report that matched their diagnosis. We also evaluated the proportion of patients with symptomatic cholelithiasis and other gallstone-related diagnoses who showed acute, chronic, or other findings on pathology.

Results

This study included 982 patients out of a total list of 1000 patients; 18 patients were excluded. Although exclusion criteria were listed in the original protocol

Table 1. Comparison between the Postoperative Clinical Diagnosis and the Pathology Report

	Pathology Findings			
Primary Diagnosis	**Negative**	**Acute**	**Non-acute****	**Total**
Acute cholecystitis	2	187	163	352
Chronic cholecystitis & other*	14	131	482	627
Gallbladder neoplasia/dysplasia	0	0	3	3
				982

Diagnoses were sorted into the following categories: 1. acute cholecystitis, 2. chronic cholecystitis and other diagnoses, 3. gallbladder neoplasia. Pathology findings were categorized as follows: 1. negative, in which pathological findings showed an intact gallbladder with no inflammation, 2. acute pathology, including acute on chronic cholecystitis, 3. any non-acute pathological changes. *Chi-squared = 109.63, df = 4, p-value = 2.2×10^{-16}*
*Other diagnoses included those that were not acute cholecystitis or gallbladder neoplasm, such as gallstone pancreatitis, biliary dyskinesia, trauma, hernia repair, small bowel obstruction, and cholecystoduodenal fistula.
**Non-acute pathological changes included chronic acalculous cholecystitis, chronic calculous cholecystitis, chronic cholecystitis with cholesterolosis, and gallbladder neoplasm.

for this study, the hospital system provided the list of patients, and the investigators reviewed all the patients to ensure these criteria were met. Two patients were excluded for being less than 10 years old. Seven patients had no pre-operative gallbladder diagnosis due to other indications for surgery. Nine patients lacked a pathology report along with other information.

This study demonstrates that patients with acute cholecystitis clinical diagnoses had acute cholecystitis on pathology in 187 of 352 cases (53.1%) (Table 1). Patients with non-acute diagnoses of cholecystitis had non-acute pathologic diagnoses in 482 of 627 cases (76.9%). A positive postoperative clinical diagnosis of acute cholecystitis had a sensitivity of 58.8% for predicting a pathology positive for acute cholecystitis. A negative postoperative clinical diagnosis of acute cholecystitis had a 75.2% specificity for a pathology negative for acute cholecystitis. The positive predictive value of a postoperative diagnosis of acute cholecystitis was 53.1%, and the negative predictive value was 79.2%.

Creating more specific categories allowed separation of unspecified symptomatic cholelithiasis from more precise chronic cholecystitis diagnoses (Table 2). The diagnosis of chronic cholecystitis was associated with chronic cholecystitis pathology in 45 of 54 cases (83.3%), and it missed 8 of 54 patients who had acute cholecystitis (14.8%). A diagnosis of "symptomatic cholelithiasis" missed acute cholecystitis in 85 of 388 cases (21.9%).

This study included 4 cases of gallbladder neoplasm. Of these 4, only 1 was considered an incidental case with a malignant neoplasm found in a patient with gallstones. Other cases of neoplasia had been identified and diagnosed prior to operative evaluation by the surgeon, resulting in 3 cases of gallbladder neoplasia/dysplasia with post-operative pathology confirmation. Although cases of gallbladder neoplasia can sometimes be diagnosed preoperatively or intraoperatively due to macroscopic findings, 25% of neoplasia cases were missed prior to the use of histopathological examination.

Discussion

Fewer than 15% of patients with cholelithiasis experience symptoms; thus, the diagnosis of gallbladder disease usually arises as a consequence of chronic inflammation of the gallbladder.[1] Nevertheless, obstruction due to an impacted stone is the underlying etiology in many cases of acute cholecystitis. For the majority of patients, the presentation of symptoms and RUQ pain ultimately result in a surgical intervention. While pathological inspection is more accurate than preoperative and intra-operative diagnoses, the resulting management of cholecystectomy required similar postoperative follow-up for these patients. We found that one case with gallstone involvement showed "malignant neoplasm" on pathology, a completely incidental finding which was not macroscopically apparent. The incidental finding of cancer will require more follow-up

Table 2. Comparison between the Postoperative Clinical Diagnosis with an Expanded Number of Categories and the Pathology Report

	Pathology Findings				
Primary Diagnosis	**Negative**	**Acute**	**Chronic****	**Gallbladder Neoplasia**	**Total**
Acute cholecystitis	2	187	163	0	352
Chronic cholecystitis	1	8	45	0	54
Cholelithiasis	4	85	298	1	388
Other*	9	38	138	0	185
Gallbladder neoplasia/dysplasia	0	0	0	3	3
					982

Diagnoses were sorted into the following categories: 1. acute cholecystitis, 2. chronic cholecystitis 3. unspecified cholelithiasis, 4. other diagnoses in which the gallbladder had to be removed, and gallbladder neoplasia confirmed with pathology. *Chi-squared = 876.54, df = 12, p-value* 2.2×10^{-16}

*Other: different diagnoses for which cholecystectomy was done, including biliary dyskinesia, trauma, gallstone pancreatitis, hernia repair, small bowel obstruction, and metastatic disease.

**Non-acute pathological changes included chronic acalculous cholecystitis, chronic calculous cholecystitis, and chronic cholecystitis with cholesterolosis, among other similar variations.

care. Intraoperative evaluation of the gallbladder does not make acute versus chronic etiology of cholecystitis readily apparent. There was a statistically significant relationship between diagnosis and resulting pathology. However, the diagnosis of acute cholecystitis was missed in 131 of 318 cases (41.2%) (Table 3).

Surgeons have several diagnostic tests available for the evaluation of patients with possible gallbladder related symptoms, including ultrasound, computed tomography, magnetic resonance imaging, and HIDA scan. More research on the pre-operative use of these modalities and their sensitivity and specificity could help reduce the proportion of missed diagnoses of acute cholecystitis. The subjective nature of charting an established diagnosis can change the wording in a patient's chart. There are many factors that contribute to surgeons listing a broad versus specific diagnose, e.g., chronic cholecystitis versus chronic cholecystitis with cholelithiasis. Documentation of more specific diagnoses in the EMR requires more time and effort than recording a less specific diagnosis. Any extra compensation for more specific diagnoses may not justify the extra time and effort. Other factors may include the timing of surgery, intraoperative visibility of the gallbladder, and the combined picture of an excised gallbladder combined with the patient's presentation. This study used broad categories to classify 982 diagnoses. The EMR software produced certain data to evaluate cholecystectomies, and the medical record was reviewed in all cases. For future research projects, additional data collection software might be used to create structured data from unstructured data. Future EMR software could create greater uniformity of preoperative and pathologic diagnoses among individual practitioners.

Table 3. Comparison of the Postoperative Clinical Diagnosis of Acute Cholecystitis with the Pathology Report

	Acute Cholecystitis Pathology	No Acute Pathology	Total
Acute	187	165	352
Non-Acute	131	499	630
Total	318	664	982

The physician's diagnosis compared with the histopathological results. The number of acute diagnoses and the number of all remaining diagnoses were split based on their pathology findings. Analysis resulted in a sensitivity of 58.8%, specificity of 75.2%, positive predictive value 53.1%, and negative predictive value of 79.2%.

Conclusion

Surgeons correctly diagnosed acute cholecystitis in about 50% of cases and diagnosed chronic

cholecystitis in 80% of cases. Incidental neoplasm was uncommon and was not always correctly diagnosed preoperatively. Patients with acute preoperative diagnoses had acute pathologic changes in 53.1% of cases. The pathologic diagnosis of acute cholecystitis was missed 41.2% of the time. In this study, patients with the diagnosis of "symptomatic cholelithiasis" had acute inflammation in 85 of 388 cholelithiasis cases. In these cases, current diagnostic modalities and operative assessment were not enough to identify the acute-on-chronic (or?) picture. Regarding the diagnosis of gallbladder neoplasm, 3 of the 4 cases of cancer in the gallbladder were identified prior to intraoperative evaluation (0.31% of the total 982 patients). Incidental gallbladder neoplasm was found in 1 of 982 patients (0.10%). With only one malignant neoplasm case found incidentally, the benefit of routine pathology in finding incidental cancer in patients must be weighed against any disadvantages (time and cost) of additional testing. This study suggests that the mismatch between the postoperative clinical diagnosis and postoperative pathology occurs frequently enough that pathology testing after cholecystectomy should remain a routine part of patient care to establish an accurate diagnosis.

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From: Baylor College of Medicine Department of Anesthesiology (CR), Houston, Texas; Albert Einstein Medical Center, Department of Urology (AA), Philadelphia, PA; Baylor Scott & White Med Center (AK), Temple, Texas; Texas Tech University Health Sciences Center School of Medicine Department of Surgery (JR, BT, MN), Lubbock, Texas; Case Western Reserve University Department of Surgery (AH), Cleveland, Ohio
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