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ORIGINAL ARTICLE

Diagnostic Accuracy of Transabdominal Ultrasound (TAUS) in Detection of the Common Bile Duct Stone in Suspected Patients Taking Intra-Operative Findings as Gold Standard

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ABSTRACT

Objective: To determine the diagnostic accuracy of transabdominal ultrasound (TAUS) in detection of the common bile duct stone in suspected patients taking intraoperative findings as gold standard.

Method: This descriptive Cross-sectional Study was conducted in new radiology department, Services Hospital Lahore from February, 2018 till August, 2018. Data from 144 patients was calculated using non**-**Probability Consecutive sampling. Chi-square was used to explore the diagnostic accuracy of transabdominal ultrasound in detecting CBD among suspected patients.

Results: the diagnosis accuracy of intraoperative surgery and TAUS for diagnosis of CBD, the results of Chi-square test revealed significant difference (X^2=82.632, P=.000). The sensitivity was 82.69%, specificity was 92.39%, PPV was 86%, NPV was 90.43% and diagnostic accuracy of TAUS was 88.89%.

Practical implication: "The study demonstrates the high diagnostic accuracy and practical benefits of transabdominal ultrasound (TAUS) as a non-invasive tool for detecting common bile duct stones, offering accessible and cost-effective diagnostic capabilities with no ionizing radiation or contrast material required."

Conclusion: To concluded that the usage of TAUS as a tool for confirmation of presence of CBD stones at initial level is very valuable because of its numerous benefits such as easy accessibility, low in cost, no contrast material is required and ionizing radiation lacking. Hence, it is evident from the findings of current study that transabdominal ultrasound is a non-invasive technique devoid of complications as well as higher level of diagnostic accuracy in terms of detecting CBD stones.

Keywords: Common bile duct stones, Transabdominal ultrasound, Diagnostic accuracy, Surgery

INTRODUCTION

Among common clinical problems, the most prevailing problem is common bile duct (CBD) stone or choledocholithiasis that may resulted in severe clinical complications, for instance, pancreatitis and acute cholangitis.[1] About 1.8 million visits of ambulant care are due to the CBD stones and yearly prevalence of cholecystectomies is higher than 7lac in the USA.[2,3] Prevalence of CBD stones was 30.4% as per literature.[4]

Literature is evident that with results of biochemical tests along with the clinical evaluation, choledocholithiasis diagnosis is not always correctly directed.[5-7] For which different imaging techniques are performed for the diagnosis confirmation. These includes transabdominal ultrasound (TAUS), magnetic resonance cholangiopancreatography (MRCP), endoscopic ultrasonography (EUS), intra-operative fluorocholangiography (IOC) and endoscopicretrograde cholangiopancreatography (ERCP). In spite of several available imaging techniques, one optimal technique to make accurate diagnosis of suspected CBD stone is still unanswerable.[8]

In Transabdominal Ultrasound high frequency of sound waves are used for the visualization of organs and tissues lie in abdomen to confirm the prevalence of disease. Generally, the usage of Transabdominal ultrasound is quite common as the initial diagnostic tests for detection CBD stones.[1,5,9] Although, TAUS is extremely operator reliant, but the valuable data could be extracted if operated by experienced person.[10] The detection of CBD stones via TAUS is in dilated form but its diagnostic accuracy is poor for identifying CBD stone.[9] According to the findings of previously conducted study using ultrasonography, sensitivity was 65%, specificity was 60%, positive predictive value was 76.47% and negative predictive value was 46.15%.[11] Similar study was conducted using TAUS which showed sensitivity as 80%, specificity as 87.5%, positive predictive value as 65.5% and negative predictive value as 56%.[12]

It has been noted that previous studies showed varied results and moreover no local study was found in literature which can help in detection CBD stone by TAUS, so to compare the diagnostic accuracy of TAUS in detecting CBD stone the need of investigation was felt, so that results of this study can be used and implemented in future. This will help the population by reducing morbidity in the form of acute cholangitis, pancreatitis and jaundice even in remote areas so that early decision can be made about treatment plan. The objective of current study was to determine the transabdominal ultrasound's (TAUS) diagnostic accuracy in terms of common bile duct stone detection among suspected patients while considering intraoperative findings as gold standard.

MATERIAL AND METHODS

This descriptive Cross-sectional Study was conducted in new radiology department, Services Hospital Lahore from February, 2018 till August, 2018. Sample size of 144 was calculated with 95% confidence interval, taking expected prevalence of 30.4%,[4] sensitivity 80%,[11] specificity 87%[12] with 10% margin of error taking intraoperative finding as gold standard. Non**-**Probability Consecutive sampling was used as sampling technique to collect data.

Inclusion Criteria: Patients of both gender with age ranges from 30year to 60 years. Clinically suspected Patients with presence of all of the following characteristics for more than 7 days: 1. Jaundice associated with fever (> 37.3 C), chills, and colicky right upper quadrant pain, 2. Raised gamma glutamyl transferase (GGT) (>90U/L), 3. CBD diameter of > 7 mm.

Transabdominal Ultrasonography diagnosis of Common bile duct stone will be labeled on the basis of presence of the following characteristics; 1. The classic appearance of CBD stone is a rounded echogenic lesion with posterior acoustic shadowing, 2. Small stones may lack good acoustic shadows and appear only as a reproducible bright, linear echogenicity either straight or curve.

Exclusion Criteria: Patients having Carcinoma of pancreas head, Cholangiocarcinoma CBD strictures and Periampullary carcinoma.

Data Collection: After the approval of study from ethical review committee of the institute, patients who were suspected to have CBD stones as per clinical evaluation and were according to the inclusion criteria of the study visited the New Radiology department of Services Hospital Lahore were recruited. Informed consent was get signed by each patient after having the briefing about the aim and procedure of study. Confidentiality of patients' data was guaranteed by giving them alpha numeric codes instead

of showing their names in data file. A sonologist with experience of more than five years was requested to perform TAUS for the diagnosis of CBD stones. Intraoperative surgery was performed for entire sample by an experienced consultant who had more than 5 years of experience. The data was taken at the time of surgery related to the existence of CBD stones. Record of patients' demographics such as age, gender and duration of disease along with TAUS and intra-operative outcomes was maintained.

Data Analysis: SPSS version 25.0 was used for data analysis. Frequency and percentages were calculated for gender, Presence of CBD, and TAUS findings. For age, and duration of symptoms, mean ±SD was calculated. Percentage of sensitivity, specificity, PPV and NPV were calculated for TAUS. Chi-square test was used to determine the transabdominal ultrasound's (TAUS) diagnostic accuracy in terms of common bile duct stone detection among suspected patients while considering intraoperative findings as gold standard**.**

RESULTS

The mean age of cases was 44.58 ± 8.90 years with minimum and maximum age of 30 and 60 years. The mean duration of disease was 14.27 ± 3.97 days with minimum and maximum 7 and 20 days respectively. There were 67(46.5%) male and 77(53.5%) female cases.

Table 1: Demographic Data

	Mean ± Std. Deviation
Age	44.58 ± 8.90 years
Duration of Disease(days)	14.27 ± 3.97
Gender	
Male	67(46.53%)
Female	77(53.47%)

No significant difference was found between the diagnosis of intraoperative surgery and TAUS (X^2= 0.061, P=.805). Common Bile Duct stones were diagnosed in 52(36.1%) patients on surgery whereas 50(34.72%) cases were diagnosed accurately on TAUS.

Table 2: Comparison of Intraoperative Surgery and TAUS in diagnosis of CBD

	Positive	Negative	X^2	Sig.
Intraoperative Surgery	52(36.11%)	92(63.89%)	0.061	.805
TAUS	50(34.72%)	94(65.28%)		

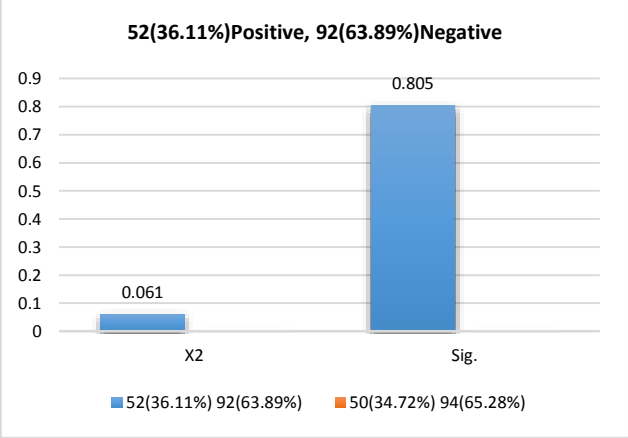

Figure 1: comparatively values of diagnosis

While comparing the diagnosis accuracy of intraoperative surgery and TAUS for diagnosis of CBD, the results of Chi-square test revealed significant difference (X^2=82.632, P=.000). Positive diagnosis of CBD using intraoperative surgery and TAUS were 43(29.9%) case whereas only 7 cases were diagnosed positive which were later on find negative during intraoperative surgery. On the other hand, only 9(6.3%) patients were not diagnosed with CBD as per the findings of TAUS which were later on found positive during intraoperative surgery. From entire data, 85(59%) cases were diagnosed as negative with both techniques.

Table 3: Diagnosis accuracy of Intraoperative Surgery and TAUS

		Intraoperative Surgery		X^2	Sig.
		Positive	Negative		
TAUS	Positive	43(29.9%)	7(4.9%)	82.632	.000
	Negative	9(6.3%)	85(59.0%)		

The sensitivity was 82.69%, specificity was 92.39%, PPV was 86%, NPV was 90.43% and diagnostic accuracy of TAUS was 88.89%.

Table 4: Sensitivity, Specificity, PPV, NPV and Diagnostic accuracy of TAUS

Variables	Percentage
Sensitivity	82.69%
Specificity	92.39%
Positive predicted value	86%
Negative predicted value	90.43%
Diagnostic Accuracy	88.89%

Bile duct stone (choledocholithiasis) is a common medical condition characterized by the presence of calculi or stones within the bile duct. It typically manifests with symptoms such as abdominal pain, jaundice, and deranged liver function tests.[13] Patients with suspected bile duct stones often have a medical history that includes risk factors such as a previous history of gallstones, biliary tract infections, or a family history of biliary disorders. [14]Imaging techniques such as ultrasound, magnetic resonance cholangiopancreatography (MRCP), or endoscopic retrograde cholangiopancreatography (ERCP) are commonly employed for diagnosis. Timely recognition and management of bile duct stones are crucial to prevent complications like cholangitis, pancreatitis, or biliary obstruction.[15]

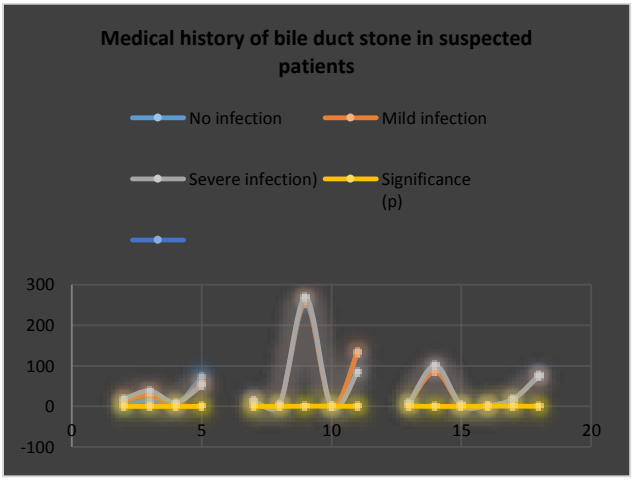

Figure 2: The statistical analysis of patient's history with bile duct infections, data was observed by suing statistical tool.

Common bile duct stones can potentially disrupt the balance of microflora in the gut, leading to adverse effects. The presence of common bile duct stones can interfere with the transformation of dietary procarcinogens into carcinogens, which may increase the risk of developing cancer. Additionally, the obstruction caused by the stones can disrupt peristalsis and affect the metabolism of dietary carcinogens.[16] This disruption can also contribute to intestinal dysbiosis disorders and increase the susceptibility to opportunistic infections and gut-derived translocation. It is important to consider the potential impact of common bile duct stones on the delicate balance of microflora and its associated functions.[17]

Table 5: The Complex Relationship Between Bile Duct Stones and Microflora: Unveiling the Dual Impacts on Health

Positive implications of microflora	Adverse effects of microflora
Bacterial competition	Transformation of dietary procarcinogens into carcinogens
Enhancement of mucosal immunity and preservation of mucosal integrity	Intestinal dysbiosis disorders
Sustaining peristalsis and metabolism of dietary carcinogens while improving the bile duct functioning	Opportunistic infection and gut derived translocation cause serious infection in different organ of body including bile duct
Production of vitamins K and B complex	
Metabolism of prodrugs	

DISCUSSION

Diagnostic accuracy for CBD stones is very significant for treatment planning.[13] There are two stages of CBD stones, i-e., primary and secondary. The prevalence of primary stones in bile duct is 10% among Asian population which causes biliary stasis as well as infections. Reasons for developing biliary stasis which results in the primary stones development includes biliary stricture, papillary stenosis, tumors and choledochal cyst.[14] The most prevalent for of CBD stones is secondary stones which are found in 90% of patients with CBD stones.[15] In western world, the majority of duct stones are found within the gallbladder. Frequency of stones in gallbladder in nearly equal to 20% among general population which is doubled among females as compared to males. Age is also a contributing factor in the occurrence of CBD stones.[16]

As per the findings of current study, the patients with CBD stones were 144 among which 67(46.53%) were males and 77(53.47%) were females which is in line with the findings of previously conducted study in which 24(33.803%) were males and 47(66.20%) were females.[12]

The findings of current study revealed that sensitivity of TAUS was 82.69% which higher than the findings of a similar study which reported sensitivity as 65%.[11] Moreover, specificity of TAUS was 92.39% which again higher than the findings of a similar study which reported specificity as 60%.[11] Additionally, PPV of TAUS was 86% which again higher than the findings of a similar study which reported PPV as 76.47%.[11] NPV of TAUS was 90.43% which was higher than the findings of a similar study which reported NPV as 46.15%.[11] Similar study was conducted using TAUS which showed sensitivity as 80%, specificity as 87.5%, positive predictive value as 65.5% and negative predictive value as 56%[12] which was less than the finding of current study.

"Accurate diagnosis of common bile duct (CBD) stones is crucial for effective treatment planning. The prevalence of primary CBD stones, which contribute to biliary stasis and infections, is 10% among the Asian population, while secondary stones account for 90% of CBD stone cases. The frequency of gallbladder stones in the general population is approximately 20%, with a higher prevalence among females. Age also plays a role in the occurrence of CBD stones. In line with previous studies, the current study, published in PJMA, included 144 patients with CBD stones, of which 46.53% were males and 53.47% were females.[22] The study found that transabdominal ultrasound (TAUS) demonstrated a sensitivity of 82.69%, specificity of 92.39%, positive predictive value (PPV) of 86%, and negative predictive value (NPV) of 90.43%. These values were higher compared to similar studies, indicating the superior diagnostic accuracy of TAUS in detecting CBD stones.[23] The use of TAUS as an initial non-invasive diagnostic tool is valuable due to its accessibility, cost-effectiveness, absence of contrast material requirement, and lack of ionizing radiation.[24]

CONCLUSION

Therefore, it could be concluded that the use of TAUS as a tool for confirmation of presence of CBD stones at initial level is very valuable because of its numerous benefits such as easy accessibility, low in cost, no contrast material is required and ionizing radiation lacking. Hence, it is evident from the findings of current study that transabdominal ultrasound is a non-invasive technique devoid of complications as well as higher level of diagnostic accuracy in terms of detecting common bile duct stones.

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