RESEARCH PAPER

A Comparative Evaluation Of T2 Space And T2 Thickslab Among Patient Of Cholelithiasis

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ABSTRACT

BACKGROUND: Gallbladder is a saclike organ which stores bile, which takes part in the digestion of fat, Cholelithiasis refers to the stones inside the gallbladder, MRCP is a gold standard modality to evaluate such disorders by 3D sequences like 3D SPACE and T2 Thick-slab.

OBJECTIVES: The compare the efficiency of T2 SPACE and T2 Thick-slab, where both are special 3D sequences of MRCP, to evaluate the cholelithiasis and other biliary disorders.

METHODS: This hospital-based comparative cross-sectional study was conducted at NIMS Hospital, Jaipur. A total of 78 patients clinically suspected of cholelithiasis were included in the study for period of 6 months. Participants were included >10 years of age who underwent Magnetic Resonance Cholangiopancreatography (MRCP) were enrolled. Under SIEMENS MAGNETOM VIDA X50 3T Scanner machine.

RESULT: T2 SPACE and T2 thick-slab methods are equally useful for evaluating biliary ducts; however, the T2 SPACE method is superior to the T2 thick-slab method for demonstrating small stones and for assessing duct size because of its high quality of three-dimensional/ 4 -dimensional imaging. The T2 thick-slab method has a faster speed and wider diameter of view than the T2 SPACE method but suffers from some volume averaging making it difficult to detect small things. In general, T2 SPACE is more accurate and reliable than T2 thicks-lab for detailed evaluation of the biliary duct.

CONCLUSION: T2 SPACE and T2 thick-slab (T2 Thick-SL) are both good for finding "cholelithiasis" on a "MRCP" exam; however, T2 SPACE will be a more accurate and clearer method of determining if a stone exists.

Keywords: MRI, MRCP, CHOLELITHIASIS, T2 SPACE, T2 THICKSLAB.

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INTRODUCTION

Cholelithiasis is a liver and gallbladder associated disorder. It causes a lot of people pain and leads to many surgeries. To avoid issues like acute cholecystitis, choledocholithiasis, pancreatitis and cholangitis it is crucial to accurately assess gallstones and biliary tract problems before surgery. Cholelithiasis and associated problems are a concern, for patients and doctors.[1] As ultrasonography is widely used as the initial imaging modality, but it has a limited ability to visualize the entire biliary tree and detect small or distal bile duct stones, which necessitates the use of advanced imaging techniques.[2]

The biliary system is the system that helps your body get rid of waste. Magnetic Resonance Cholangiopancreatography is very good at finding problems like stones in the bile duct. The common bile duct is a tube that carries waste from your body. MRCP is a non-invasive and safe option as compared to ERCP or any other invasive techniques.[3] T2 thick-slab sequence allows rapid image acquisition and provides a broad projectional view of the biliary tree, making it useful for initial screening and anatomical orientation. However, its diagnostic performance may be affected by partial volume effects, which can mask small calculi or subtle ductal abnormalities. [4,5] T2 SPACE is that it is a kind of scan that takes pictures in 3D reconstruction and in minimum slice thickness. This means doctors can see things clearly and from many different angles. It is especially good for finding stones and blockages in the bile ducts.[6]

METHODS:

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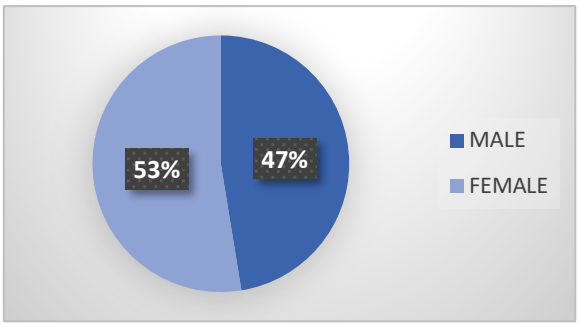
This hospital-based cross-sectional study was conducted at NIMS Hospital, Jaipur, for a six-month study with 78 patients with suspected cholelithiasis (the presence of gallstones) referred for Magnetic Resonance Cholangiopancreatography (MRCP) imaging. Before imaging, informed consent was obtained from each patient, and all patients received proper preparation, including fasting and removal of any metallic objects. All MRI examinations were performed with a 3 Tesla MR scanner using appropriate patient positioning and a body coil.
Two MRCP imaging sequences using T2 SPACE and T2 thick-slab sequences were obtained for each patient using routine imaging protocols. The two MRCP sequences were analyzed systematically for the presence, number, size, and location of biliary calculi. The clarity of biliary duct visualization was studied and particular attention was given to detecting small stones and evaluating the anatomy of the bile duct. All findings were documented using a standardized data collection form. The data were subsequently analyzed in Microsoft Excel, with the comparative diagnostic parameters and image quality of both MRCP imaging sequences assessed to establish the accuracy of either imaging sequence in detecting cholelithiasis and evaluating the biliary system.

RESULT:

TABLE 1 EXPLANATION: Represents the frequency distribution of gender among the patients within the sample of 78 cases illustrates a predominance of females, contributing 53.00% of the total population. Males, on the other hand, accounted for 47.00% of the sample.

TABLE 1: FREQUENCY DISTRIBUTION OF GENDER OF PATIENTS.

GENDER	**n=78**	**In %**
MALE	37	47.00%
FEMALE	41	53.00%



Graph 01: FREQUENCY DISTRIBUTION OF GENDER OF PATIENTS

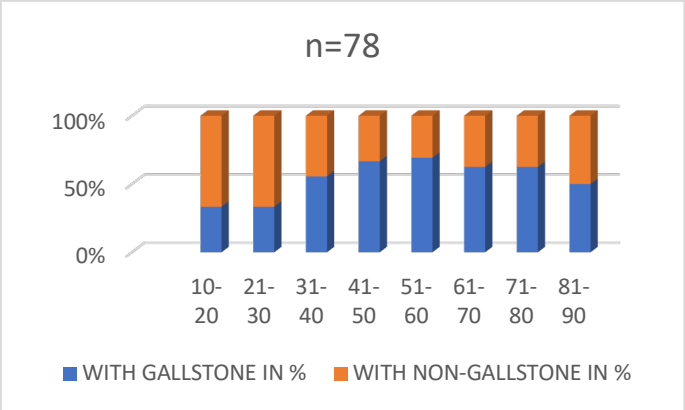
DISTRIBUTION OF AGE OF PATIENTS

TABLE 2 Explanation: Represents the distribution of patients based on age within the sample of 78 cases varied age intervals. Its revealing which age range is most affected by the cholelithiasis and which is the least effected within the sample. Here we can see 41 to 50, 61 to 70 and 51 to 60 age range is the most effected by the gall stone respectively.

TABLE 2: FREQUENCY DISTRIBUTIONS OF PATIENTS

AGE RANGE	WITH GALLSTONE IN %	WITHOUT GALLSTONE IN %
10-20	1.282051282	2.564102564
21-30	3.846153846	7.692307692
31-40	6.41025641	5.128205128
41-50	15.38461538	7.692307692
51-60	11.53846154	5.128205128
61-70	12.82051282	7.692307692
71-80	6.41025641	3.846153846
81-90	1.282051282	1.282051282

Graph 02: FREQUENCY DISTRIBUTIONS OF PATIENTS

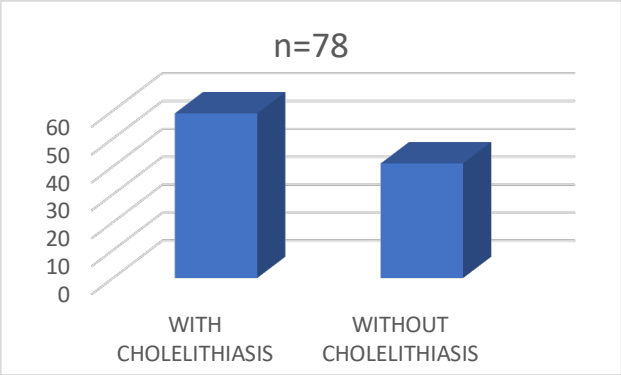


DISTRIBUTION OF MRCP FINDINGS ON PATIENT HAVING CHOLELITHIASIS

TABLE 3 Explanation: The distribution of patients are according to the MRCP impression of cholelithiasis within a sample of 78 cases. In the taken population 46 patients are affected with cholelithiasis and rest 32 patients are not affected with cholelithiasis.

CHOLELITHIASIS	**n=78**	**IN %**
WITH CHOLELITHIASIS	46	58.97435897
WITHOUT CHOLELITHIASIS	32	41.02564103

TABLE 3: FREQUENCY DISTRIBUTION OF MRCP FINDINGS ON PATIENT HAVING CHOLELITHIASIS



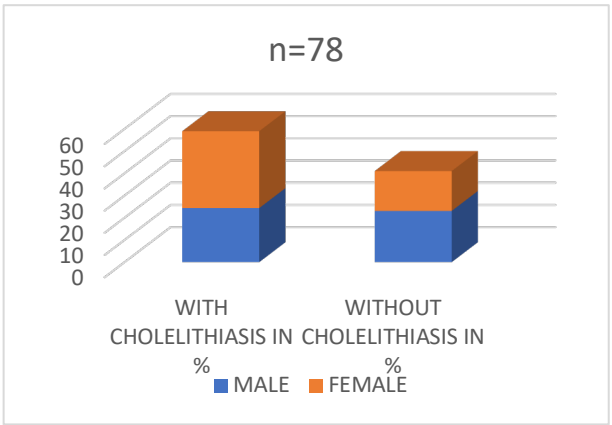
Graph 03: FREQUENCY DISTRIBUTION OF MRCP FINDINGS ON PATIENT HAVING CHOLELITHIASIS

DISTRIBUTION OF GENDER AFFECTED AND NOT AFFECTED WITH CHOLELITHIASIS

TABLE 4 Explanation: The table shows the distribution of male and female patients who is with cholelithiasis and without cholelithiasis, where the female patients (27) are mostly affected by cholelithiasis than male (19) patients.

GENDER	WITH CHOLELITHIASIS IN %	WITHOUT CHOLELITHIASIS IN %
MALE	24.35897436	23.07692308
FEMALE	34.61538462	17.94871795

TABLE 4: FREQUENCY DISTRIBUTION OF GENDER AFFECTED AND NOT AFFECTED WITH CHOLELITHIASIS



Graph 04: FREQUENCY DISTRIBUTION OF GENDER AFFECTED AND NOT AFFECTED WITH CHOLELITHIASIS

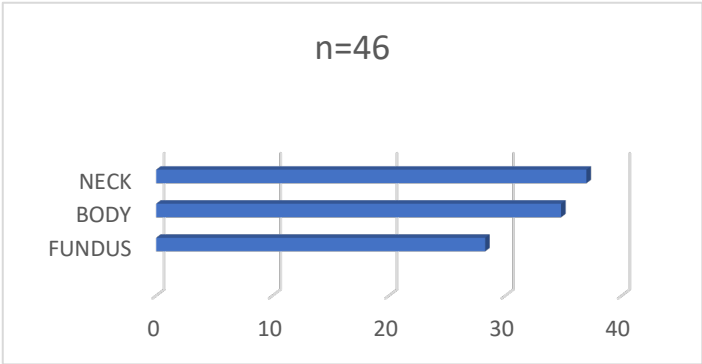
DISTRIBUTION OF REGIONS AFFECTED THROUGH CHOLELITHIASIS AMONG THE AFFECTED PATIENTS

Table 5 Explanation: This table revealing that the region of the Gall Bladder affected through cholelithiasis among the affected subject number (n=46), Here, it is revealed that among the affected population the neck region of the Gall-bladder is mostly affected by the cholelithiasis.

REGION OF GB	NUMBER OF PATIENTS (n=46)	IN %
FUNDUS	13	28.26086957
BODY	16	34.7826087
NECK	17	36.95652174

TABLE 5: FREQUENCY DISTRIBUTION OF REGIONS AFFECTED THROUGH CHOLELITHIASIS AMONG THE AFFECTED PATIENTS

Graph 05: FREQUENCY DISTRIBUTION OF



REGIONS AFFECTED THROUGH CHOLELITHIASIS AMONG THE AFFECTED PATIENTS

STEPS TO CALCULATE CHI-SQUARE VALUE IN EXCEL:

	T2 SPACE POSITIVE	T2 SPACE NEGATIVE
T2 Thick-slab Positive	42 (a)	0 (b)
T2 Thick-slab Negative	4 (c)	0 (d)

TABLE 6: CHI-SQUARE TABLE

Total discordant pairs:(b+c) = (0+4) = 4
Smaller value (among b and c): 0
Exact McNemar test was applied due to small number of discordant pairs (b + c = 4).

Calculation to find p- value:

p-value = 2*BINOM.DIST[Min (b, c), b+c,0.5, TRUE)]

=

2*BINOM.DIST(0,4,0.5, TRUE)

= 0.125

The p-value is greater than 0.05 (0.125 > 0.05)
Which indicates, the study is not statistically significant (p > 0.05).
To calculate sensitivity:
Sensitivity = [True Positive / (True Positive +False Negative)]
Total affected patient with cholelithiasis is 46.
T2 SPACE detected 46 cases out of 46 affected patients, so

Sensitivity of T2 SPACE: 46/46 = 1 (100 %)
T2 Thick-slab detected 42 cases out of 46 affected patients, so Sensitivity of T2 Thick-slab: 42/46 = 0.9130 (91.30 %)

DISCUSSION:

Mishra et al. (2024) [7] reported in their study, that they have noticed higher incidence of cholelithiasis in females. In our study also it had been observed a female predominance (53%) in cholelithiasis cases, which supports the well-established hormonal influence in gallstone formation.

Manisha Kumari et al. (2022) [8] and **Mishra et al. (2024)** [7] reported in their study that gallstone disease is more prevalent in the middle-aged population. The age distribution of our study also represented that subjects between 41–70 years were most commonly affected by cholelithiasis.

Lakshmi Meenakshi et al. (2023) [9] reported in their study about the sensitivity of MRCP in evaluation of cholelithiasis is up to 98–100%. In our study it was observed that 58.97% of patients were diagnosed with cholelithiasis using MRCP. This supports previous literature indicating that MRCP is highly sensitive in detecting biliary calculi.

Yeniçeri et al. (2019)[10] and **Kumari et al. (2022)** [11] indicated MRCP as a preferred alternative to invasive techniques like ERCP. In our present study it is also confirmed that MRCP is a highly reliable, non-invasive diagnostic modality.

Chien et al. (2020) [12] demonstrated in their study about enhanced ductal visualization using advanced 3D MRCP sequences, our study also observed that T2 SPACE allows better 3D reconstruction and anatomical delineation, which is also a supporting finding.

We found out that a lot of people have gallstones in the neck part of the gallbladder, which's about 36.9%. This information is helpful because it tells us more about the anatomy of the gallbladder. There are not studies that look at where gallstones are in the gallbladder but our results are similar to what other studies have found when they looked at pictures of the gallbladder. The gallbladder and gallstones are an area of study because we want to know more, about gallbladder problems and where they happen. The gallbladder and gallstones are what we are looking at in our study.

Performed Mc-Nemar's test: In the Mc-Nemar's test, we evaluated the comparison between T2 SPACE and T2 Thick-slab, which is appropriate for paired data. As the number of discordant pairs were small (b +c=4), the exact Mc-Nemar's test was applied, the obtained p-value (p = 0.125), indicated no statistically significance between these two sequences. Where, clinically relevant difference were observed. T2 SPACE detected additional cases of cholelithiasis that were missed on T2 Thick-slab imaging, This may be attributed to its high-resolution three-dimensional acquisition and reduced partial volume effects, enabling better visualization of small calculi. But T2 thick-slab is also faster and effective for overview imaging, may miss smaller stones.

The lack of statistical significance may be due to small sample size and limited discordant cases. Therefore, while both sequences are statistically comparable, T2 SPACE demonstrates a clinically meaningful advantage in detailed biliary evaluation.

Sensitivity: In the sensitivity test it was found that, the sensitivity of T2 SPACE in identifying all types of stones is 100 %, where the sensitivity of T2 Thick-slab is 91%, which also explains about the high sensitivity of T2 SPACE in detection of cholelithiasis.

CONCLUSION:

MRCP is established as one of the most important ways to look at gallstones and possible gallbladder stones without requiring a surgical procedure. Within 78 patients with gallbladder stones, females and those between 41 and 70 years of age were the two most affected populations; both types (male and female) are affected similarly. T2 SPACE and T2 thick-slab images were also good indicators for small gallstones, but T2 SPACE had the highest potential for small gallstones; however, the shapes of the developing gallstones were highly correlated at the common gallbladder stone and neck locations. Because MRCP provides more accurate diagnoses than previous methods, it also allows for better planning of treatment and reduces the chance of needing to do any invasive procedures.

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