

## Comparing the efficacy of preoperative magnetic resonance cholangiopancreatography with intra-operative cholangiography in patients suspicious to biliary stones

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### ABSTRACT

**Aim:** This study was performed to compare the efficacy of preoperative magnetic resonance cholangiopancreatography (MRCP) and intra-operative cholangiography (IOC) methods in patients suspicious to gall stones.

**Background:** According to previous studies, it is recommended that common bile duct investigation should be done in order to rule out choledocholithiasis in all patients with symptomatic cholelithiasis. IOC is an invasive procedure with probable complications, it would seem that MRCP could replace the direct cholangiography.

**Patients and methods:** In a diagnostic clinical trial, Fifty-nine patients with symptomatic biliary stones or cholecystitis were recruited in this study. The included patients had normal size biliary ducts in sonography but high serum alkaline phosphatase level. Preoperative MRCP and IOC were performed for the patients and the obtained results were analyzed and compared.

**Results:** The positive predictive value for IOC was 88% and for MRCP was 43%. The diagnostic accuracy of IOC and MRCP were 98% and 85% respectively, suggesting that IOC is much more diagnostically accurate. There were no significant difference in specificity and sensitivity of these two methods.

**Conclusion:** According to the results, we can conclude that MRCP may not obviate the need for IOC. The suggestion for routine use of MRCP instead of IOC and as a substitution of that procedure needs further investigations on more patients.

**Keywords:** Magnetic resonance cholangiopancreatography, Intra-operative cholangiography, Gall stone, Cholecystitis, Alkaline phosphatase.

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### Introduction

Gallstones are among the most prevalent clinical problems all around the world. Based on published studies, the prevalence of gall stones in Europe is about 5-20% in the general population,

rising with age. The incidence of gallstones is three times more common in women than in men (1-3). Twelve percent of patients with symptomatic gall stone disease have common bile duct stones (4). Choledocholithiasis may be asymptomatic; or it may cause serious problems, such as obstructive jaundice, pancreatitis and cholangitis, which can complicate disease management, especially in older patients.

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According to previous studies, it is recommended that common bile duct investigation should be done in order to rule out choledocholithiasis in all patients with symptomatic cholelithiasis. Bile duct calculi in majority of cases are predictable on the basis of clinical, biochemical and radiological examinations. Sensitivity and specificity of laboratory tests are poor. Ultra-sonography (USS) is an available, low cost, non-invasive test, with no need for ionizing radiation. USS can measure the diameter of intra and extra hepatic bile ducts, indicating whether it is dilated or not. However, it misses approximately 65% of bile duct stones because of the interference with bowel gas and also because ultra-sonography is a procedure highly operator dependent (3-6). Intra-operative cholangiography (IOC) is the gold standard procedure in the diagnosis of bile duct stones. But it is invasive, needs anesthesia, elongate the duration of operation and anesthesia and may increase intra and post-operative complications. Studies recommend trying to move to a procedure much safer, more cost effective with less complication. Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive procedure that gives high resolution images of the biliary tree without any exposure to ionizing radiation (3, 7). Its role in identifying uncertain anatomy and visualizing the bile duct stones is well-established (8). Investigations show that comparing to direct cholangiography, MRCP has found to be sensitive and specific (3,7,9,10). Therefore, given that IOC is an invasive procedure with probable complications, it would seem that MRCP could replace the direct cholangiography when it used for diagnostic purposes based on studies indicate that it is a sensitive and specific diagnostic procedure (7). We performed this study to compare the efficacy of IOC and MRCP in patients thought to have biliary stones, considering the sensitivity, specificity, positive predictive value and negative predictive value of these two

procedures. Through this study we can help answering the question below:

Can pre-operative MRCP obviate the need for IOC?

## Patients and Methods

### *Patient Selection*

Fifty-nine consecutive inpatients with suspected common bile duct (CBD) stones admitted to the surgery unit of Imam Hossein medical center, Tehran, Iran, were recruited in the study over a period of 24 months. Patients had the mean age of  $55 \pm 6$  SD years (range 36-68). These patients had symptomatic cholelithiasis and were suspicious to have CBD stones. We studied them after obtaining their approval from the ethics committee of the university hospital, Imam Hossein hospital, Tehran, Iran. After taking a history and examination, blood tests and routine biochemical assays including serum liver enzymes, bilirubin, amylase and alkaline phosphatase were done for the patients. An abdominal USS was performed to look for the presence of gallstones and any signs of a CBD stone or bile duct dilation. Patients included in this study all had normal sonography but higher than normal alkaline phosphatase level ( $Alph > 200$ ) and were clinically suspicious to common bile duct (CBD) stones. Any patient with derangement in other liver tests (such as bilirubin) or documented biliary stone diagnosed by USS were excluded from the study. If in a patient scheduled for cholecystectomy according to these investigations there was a strong suspicion to choledocholithiasis, the patient received preoperative MRCP, and then undergone IOC along with subsequent cholecystectomy. All MRCP scans were analyzed by a radiologist who was unaware of IOC and lab test results. Cholecystectomies were performed in a standard manner by one surgeon, the operating surgeon initially assessed IOC, and the film was

**Table 1-** Statistics and its relative 95% confidence interval

	IOC	MRCP	P	Diff (95%CI)
TP	7	6		
TN	36	44		
FP	1	8		
FN	0	1		
Sensitivity	100(56-100)	86(49-97)	0.301	14(11-40)
Specificity	97(86-100)	85(72-92)	0.505	12(-2-24)
PPV	88(53-98)	43(21-67)	0.040	45(10-79)
NPV	100(90-100)	98(88-100)	0.368	2(-2-6)
DA	98(88-100)	85(73-92)	0.028	13(3-23)
LR+	37(5-263)	6(4-8)		
LR-	0(-)	0.17(0.02-1.03)		
DO	-	33(3.5-312)		
Kappa	0.92(0.63-1)	0.49(0.26-0.73)		

TP= True positive, TN= true negative, FP=False positive, FN=False negative, PPV= Positive predictive value, NPV =Negative predictive value, DA= diagnostic accuracy, LR= likelihood ratio, DO= diagnostic odds

subsequently reported by one, blinded radiologist who was unaware of MRCP scan results either. Based on recorded data, specificity, sensitivity, positive and negative predictive values were individually calculated for both procedures (MRCP and IOC). Sensitivity was the ability to identify patients with CBD stones using the number of positive MRCP diagnoses divided by the total number of patients with confirmed CBD stones by IOC. Specificity was the ability to identify patients without CBD stones using the number of negative MRC diagnoses as a percentage of the total number of patients without IOC-proven CBD stones. Positive and negative predictive values of MRC were determined by the proportion of MRCP diagnoses (positive or negative) confirmed by IOC. A significant difference was considered if a p- value was < 0.05. Statistical analyses were performed using the SPSS software (SPSS17, SPSS Inc. Chicago, IL).

**Results**

In this study the mean age of the patients was 55 with the standard deviation of 6 years. Female to male ratio was 42 to 17. Mean level of alkaline phosphatase was 492 with the standard deviation of 26 (Table 1). We can see the age and sex

distribution and the range of patients' alkaline phosphatase in figures 1, 2 and 3 respectively.

The positive predictive value for IOC was 88%, comparing to MRCP which was 43%. The difference was significant with the p-value less than 0.05 (p=0.04). These findings show that we had lots of false positive results performing MRCP comparing with IOC. The diagnostic accuracy of IOC and MRCP were 98% and 85%, respectively. The diagnostic accuracy difference of these two procedures were significant either (p=0.02) which means IOC is much more accurate. The sensitivity and specificity of IOC were 100, 97 percent. In contrast the sensitivity and specificity of MRCP were 86 and 85 percent. There were no significant and meaningful differences between the sensitivity and specificity statistics based on statistical analysis (Table 2).

**Table 2.** Distribution of age, sex and Alph in studied patients

Variables	Statistics	
age	Mean ± SD	55±6
	Median (Range)	55(36-68)
ALK	Mean ± SD	492±266
	Median (Range)	430(270-1970)
Sex	F/M (%)	42/17(29)
Observed	N (%)	7(12)

## Discussion

The incidence of common bile duct (CBD) stones among the patients undergoing cholecystectomy is reported as approximately 12%. There are some symptoms, signs and investigations that should arouse suspicion of a CBD stones including derangement in Liver function test (LFT)s , dilated CBD in ultrasound (US). Although a small percentage of patients have silent CBD stones. Routine Intra-operative cholangiography (IOC) is performed, by some surgeons, for several reasons. Firstly through this procedure we can confirm that CBD is clear and find unsuspected stones in CBD. But according to the evidences 1% of patients with normal LFT and ultra-sonography have stones in their CBD and 75% of these stones passes spontaneously (4, 19-21). The disadvantage of this procedure is that we force an unnecessary CBD exploration to the patient and prolongation of the operation, because of the radiography and also because of surgical dissection and cannulation. Preoperative evaluation of the biliary tree has assumed a great importance in patients suspicious to choledocolithiasis and may help us avoiding intra-operative difficulties. Performing a confident assessment of the CBD prior to the surgery may reduce or obviate the need for hazardous and timeconsuming IOC (3, 11). Several diagnostic and therapeutic strategies have been suggested for clinical diagnosis and management of CBD stones such as routine MRCP, selective Endoscopic retrograde cholangiopancreatography (ERCP), routine IOC or endoscopic US with CBD exploration. However no single method is both risk free, highly sensitive and specific currently in use(11-14). MRCP imaging has been used for detection of CBD stones recently. Results from different studies demonstrate that sensitivity and specificity of MRCP for detection of CBD stones is high and the resolution of the biliary tree images is excellent. These investigations confirm the

accuracy of MRCP in diagnosis of CBD stones (15-17). Recent studies comparing MRCP with IOC or ERCP confirmed that MRCP has the accuracy up to 95% (7, 22, 23). Studies comparing ERCP with MRCP indicates that reliance upon MRCP findings may have reduced the requirement for ERCP and sphincterotomy by up to 75% (22, 24). In our study there were no significant differences in sensitivity, specificity between the two procedures MRCP and IOC. But based on our study the diagnostic accuracy of IOC was higher than MRCP (98 % Vs 85%) and this difference was statistically significant ( $p=0.02$ ). Our study suggests that IOC cannot be replaced by MRCP. The positive predictive value of IOC was 88%, compared to MRCP that was 43% ( $p=0.04$ ). These findings indicates that MRCP has significant false positive results compare to the IOC and based on MRCP only, we may perform unnecessary operations to a few number of patients. Considering these results, we feel that although using pre operative MRCP reduces the duration of operation and is less invasive comparing with routine IOC (7, 9, 10, 18), it does not have the diagnostic accuracy of the IOC. It may reduce unpredictable damages to the CBD during the IOC but it has significant false positive cases. Therefore it seems that performing MRCP may not obviate the need for IOC. Obviously there is no right answer at present. The role of routine IOC during cholecystectomy remains controversial (25-27). Dalton et al (7) reported that MRCP should be the only modality used to exclude CBD stones – this approach would make the IOC unnecessary. Although based on this study IOC is much more accurate. So individual centers must design their own strategies based on local factors including geographical location, personnel, equipment and facilities such as ERCP and MRCP, economic factors (time resources, private or teaching hospital) and the experience of the operating team. In conclusion the suggestion advocating routine use of MRCP instead of IOC or as a substitute for

IOC needs further investigations on more patients. Not only should we consider all the advantages and disadvantages of these two procedures (IOC, MRCP) but also we should perform some further investigations in order to find out which of these two procedures is the most cost-effective based on local circumstances in different centers. With further studies we may be able to choose a procedure less invasive, less expensive, with lower rate of complications and of course more diagnostic accuracy.

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