Preoperative evaluation of a CBD stone in patients with gallstone disease

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Preoperative evaluation of a CBD stone in patients with gallstone disease

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ABSTRACT

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Purpose: To suggest appropriate selection criteria for the preoperative diagnostic modality for patients with gallstone disease

Methods: Retrospectively, we reviewed 148 patients who had preoperatively underwent a magnetic resonance cholangiography (MRC) or an endoscopic retrograde cholangiography (ERC) before a laparoscopic cholecystectomy (LC) for cholelithiasis from Jan 1999 to Jul 2002. The choice between a MRC and an ERC was decided according to the clinicians' preference or subjective confidence; the 'MRC group' (n=57) preferentially underwent a MRC, then an ERC if indicated; the 'ERC group' (n=91) preferentially underwent an ERC without a MRC. The patients were also retrospectively divided into four risk groups (Group 1- very high, Group 2- high, Group 3- moderate, Group 4- low) based on the level of suspicion for common bile duct (CBD) stones. The incidences of choledocholithiasis and rate of a

'purely diagnostic' ERC were compared between the two modality groups.

Results: Between the two modality groups, the prevalence of a CBD stone was similar according to the risk groups. The number of patients classified in the 'very high' risk group was significantly larger in the ERC group than the MRC group. For the MRC group (n=57), 31(54%) patients were diagnosed as free of a CBD stone, and directly underwent a LC after a MRC without undergoing an ERC or an intraoperative cholangiography. Among the remaining patients of the MRC group, two were diagnosed with choledocholithiasis by an ERC, an endoscopic sphincterotomy was performed on five patients in the absence of a choledocholithiasis, and purely diagnostic ERCP was performed in five (8.8%) patients. For the ERC group (n=91), CBD stones were detected and endoscopically removed in 33 (36%) patients, whereas an ERC showed no CBD stones in 49 (54%) patients and had technically failed to cannulate the bile duct in nine (10%) patients. The number of 'purely diagnostic' ERC cases was significantly smaller in the MRC group (8.8%) than the ERC group (38.5%). The incidence of CBD stone was 32 of 37 (86.5%) in Group 1, eight of 35 (22.9%) in Group 2, five of 37 (13.5%) in Group 3, and zero of 39 (0%) in Group 4. Recurrences of CBD stones were found in two patients of the ERC group, but none in the MRC group.

Conclusion: By using a MRC preferentially before a LC on patients who have a moderate or high risk of CBD stones, purely

diagnostic ERC can be significantly reduced.

Key words: MR choalngiography, ERCP, cholelithiasis,
choledocholithiasis, laparoscopic cholecystectomy

Preoperative evaluation of a CBD stone in patients with gallstone disease

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I . INTRODUCTION

Choledocholithiasis is detected in 8% to 20% of patients undergoing a cholecystectomy for cholelithiasis[1-5]. This is the laparoscopic era, therefore, accurate preoperative identification and proper treatment of CBD stones are essential for the management of gallstone patients because residual stones may cause significant morbidity.

To date many authors have reported on the accuracy of a magnetic resonance cholangiography (MRC) compared to an endoscopic retrograde cholangiography (ERC)[6-15]. However, there is no consensus on the selection criteria for deciding which modality should be used in the preoperative evaluation of a cholecystectomy due to calculous cholecystitis and for the diagnosis of coexistent choledocholithiasis. In many cases, the selection of a diagnostic modality has been chosen according to

surgeons' preference based on their experience, the endoscopists' skill, or the institutional facility.

The aim of this study is to suggest appropriate selection criteria for preoperative diagnostic modalities by analyzing clinical course and biochemical and sonographic results of patients undergoing a MRC or an ERC before a laparoscopic cholecystectomy (LC).

II. MATERIALS AND METHODS

This study included 148 patients (sex-83 males, 65 females, age range- 21-83 years, mean age- 54.7 years) who had undergone a MRC or an ERC prior to a LC among 956 patients who had undergone a LC for symptomatic gallstone disease between January 1, 1999 and July 31, 2002. Retrospectively, we reviewed clinical symptoms, results of serum biochemical tests and radiologic findings, and the prognoses of the patients.

Preoperative evaluation for all patients consisted of abdominal sonography, serum biochemical tests [total bilirubin, transaminase (AST, ALT), gamma-glutamyl transferase (γGT), alkaline phosphatase (ALP), amylase and lipase]. A MRC or an ERC was performed under the suspicion of choledocholithiasis. Physicians or surgeons chose between a MRC and an ERC according to the clinical and laboratory findings and their preference. However, no strict indication was used to perform the MRC or the ERC, similarly, no selection criteria were used to choose between the MRC and ERC.

Retrospectively, patients were divided in two modality groups; the 'MRC group' (n=57) preferentially underwent MRC, then an ERC if clinically indicated and the 'ERC group' (n=91) preferentially underwent an ERC without a MRC.

The patients were also retrospectively divided into four risk groups (Group 1- very high, Group 2- high, Group 3- moderate, Group 4- low) based on the level of suspicion for CBD

stones. Group 1 (very high risk group) included patients with cholelithiasis, a presence of biliary colic, a CBD diameter of 6 mm or more by sonography, and two or more significant serum chemistry abnormalities, and without the evidence of biliary pancreatitis. Group 2 (high risk group) included patients with cholelithiasis, a CBD diameter of 6 mm or more, and two or more significant serum chemistry abnormalities, and in the presence of biliary pancreatitis or resolving choledocholithiasis. Group 3 (moderate risk group) included patients with cholelithiasis, a CBD diameter of less than 6 mm, and one or more significant serum chemistry abnormalities, and in the presence of acute pancreatitis or resolving choledocholithiasis. Group 4 (low risk group) included patients with cholelithiasis, a CBD less than 6 mm, and normal or minor serum chemical abnormalities, and without the evidence of pancreatitis. Resolving choledocholithiasis was defined as a case that initially presented with significant serum biochemistry abnormalities but then had a subsequent resolution or a decrease in the degree of abnormality before the LC. Biliary pancreatitis was defined as the presence of cholelithiasis, a persistent abdominal pain, and a three times larger than normal value in serum amylase or lipase, without other causes of pancreatitis. Criteria for the risk groups and the definition of significant serum chemistry abnormalities are listed in Table 1. We used the criteria for risk groups, previously suggested by Liu et al[9] with modification.

Each MRC was performed with a 1.5-T system (Horizon,

GE medical system, Milwaukee, Wis, USA) using a phased-array multicoil. Coronal and transverse localizer images were initially obtained using a spoiled gradient-recalled sequence. Subsequently, thin-section T2-weighted images were obtained using a single-shot half-Fourier rapid-acquisition and relaxation sequence (effective echo time 66-100msec, field of view 32 x 24cm, section thickness 4 mm without gap). Multisection images were obtained using a long effective TE (640 - 870msec) and a spatial fat saturation technique (other parameters were the same for T2-weighted images), and single thick-section images (echo time 830-1050msec, section thickness 30 - 50mm, field of view 24 x 24cm) were obtained in the coronal, lateral and left and right 15°, 30°, and 45° oblique planes. The above sequences are included in the routine MRC protocol at our institution.

Each MRC was interpreted by one experienced radiologist (M.J.K.) at a reading session attended by residents and fellows. A CBD stone was defined as a nodular area of low signal intensity within a high-signal-intensity lumen. An ERC was performed and reported by the expert gastroenterologists (J.B.C., S.Y.S., S.W.P.). A LC was carried out by hepatobiliary surgeons (W.J.L., J.S.C., K.S.K.).

The presence or absence of CBD stones was confirmed by an ERC or an IOC. In the patients who had only undergone a MRC, the presence of CBD stones was excluded according to normal laboratory findings and the absence of stone-related symptoms in the follow-up period. The patients were routinely followed up

in an outpatient clinic 1 week after the LC and 6 months or 1 year after the LC if they had no biliary symptoms. The patients were considered well if they didn't visit a hospital during the follow-up period.

The incidences of choledocholithiasis, the case number of purely diagnostic ERC, and the rate of a symptomatic retained CBD stone during the follow-up period (10 to 26 months) were compared between the two modality groups by t-test and among the four risk groups by a multiple comparison post-hoc test. Statistical analyses were performed with SPSS 10.0.

Table 1. Criteria for risk groups according to clinical, laboratory and sonographic findings

Group 1 (very high risk)
Biliary colic. No evidence of pancreatitis or cholecystitis. Common bile duct at sonography ≥ 6 mm Two or more significant serum chemistry abnormalities
Group2 (high risk)
Cholecystitis, acute pancreatitis, or resolving choledocholithiasis Common bile duct at sonography ≥ 6 mm Two or more significant serum chemistry abnormalities
Group3 (moderate risk)
Cholecystitis, acute pancreatitis, or resolving choledocholithiasis Common bile duct at sonography < 6 mm One or more significant serum chemistry abnormalities
Group4 (low risk)
Biliary colic or cholecystitis. No evidence of pancreatitis. Common bile duct at sonography < 6mm Normal or minor serum chemistry abnormalities
Significant serum chemistry abnormalities 1)Total bilirubin ≥ 1.5 mg/dL 2)Alkaline phosphatase ≥ 150 IU/L 3)γGT ≥ 100 IU/L 4)AST ≥ 100 IU/L 5)ALT ≥ 100 IU/L

III. RESULTS

1. Modality groups

There was no statistical difference between the ERC and the MRC group with respect to age, sex and serum chemistry results except the γGT by t-test. CBD stones were diagnosed in 45 (30.4%) of all the 148 patients, 33 (36.3%) of the ERC group, and 12 (21.1%) of the MRC group, respectively. Comparisons between the ERC and the MRC group are summarized in Figure 1.

In the ERC group (n = 91), CBD stones were present in 33 (36.3%) patients and endoscopically removed, whereas the ERC showed no CBD stones in 49 patients (53.7%), 14 patients of whom underwent an endoscopic sphincterotomy (EST). The ERC had technically failed to cannulate the bile duct in nine patients (9.9%). Therefore, the ERC was purely diagnostic in 35 patients (38.5%).

In the MRC group (n = 57), CBD stones were present in 12 (21.1%) patients. The MRC depicted CBD stones in 13 patients, 12 of whom preoperatively underwent an ERC and the remainder underwent an intraoperative cholangiograhy (IOC). Three of the 13 patients showed no CBD stones by an ERC or an IOC (false positive MRC = 5.3%). These three patients were regarded clinically as having passed a CBD stone because the serum total bilirubin and the ALP levels that had been elevated before the MRC were decreased at the time of the ERC. MRC showed no

CBD stones in 44 patients of whom 32 subsequently underwent a LC without undergoing an ERC or an IOC. Twelve patients underwent an ERC in spite of a negative MRC, and CBD stones were detected in two patients (false negative MRC=3.5%). One of the two showed normal biochemical test results at the time of the MRC but showed abnormality at the time of the ERC. A tiny stone was demonstrated by an EST in the remaining one. Five of the 12 patients underwent an EST in the absence of CBD stones. ERC was purely diagnostic in the remaining five patients (8.8 %).

2. Risk Groups

The proportion of each risk group in each modality group is presented in Figure 2. Serum chemistry data and statistical differences among risk groups are summarized in Figure 3. Group 2 vs. Group 3 showed no statistical difference in serum biochemistry results except at the amylase level.

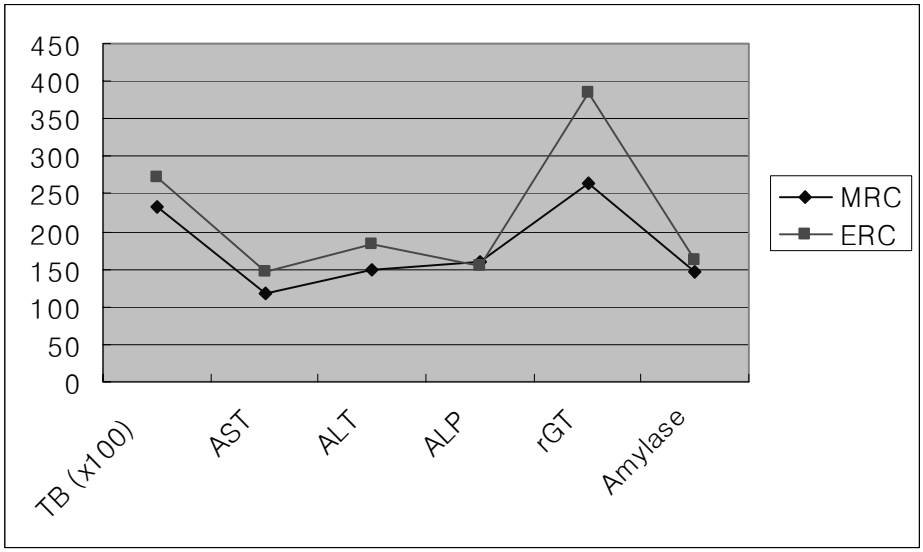
The incidence of a CBD stone was 32 of 37 (86.5%) in Group 1, 8 of 35 (22.9%) in Group 2, 5 of 37 (13.5%) in Group 3, and 0 of 39 (0%) in Group 4. The rates of occurrence of a CBD stone in the MRC and the ERC group according to risk group are listed in Figure 4. In each risk group, the incidence of a CBD stone was not significantly different between the MRC and the ERC group.

The rate of a purely diagnostic ERC in each risk group and modality group is presented in Table 2.

3. Retained CBD stone after LC

The follow-up period after a LC was 10-26 months. Biliary obstructive symptoms due to retained CBD stones were identified in two patients. CBD stones were detected 6 months and 1 year after the LC in each patient and their preoperative risk group was 1 and 3, respectively. They were included in the ERC group and retained CBD stones were not detected in the MRC group.

Figure 1. Comparison between the MRC and the ERC group



	MRC group	ERC group	
Age	58.1	52.6	NS
Sex ratio (M:F)	0.78	0.78	NS
TB (x100) (mg/dL)	233.9	271.1	NS
AST (IU/L)	117.4	147.4	NS
ALT (IU/L)	148.5	183.0	NS
ALP (IU/L)	160.0	155.1	NS
ɣ-GT (IU/L)	265.0	384.8	<.05
Amylase (U/L)	146.1	161.5	NS
CBD stone rate (%)	21.1	36.3	

NS: not significant, TB: total bilirubin

Figure 2. The proportion of each risk group in each modality group

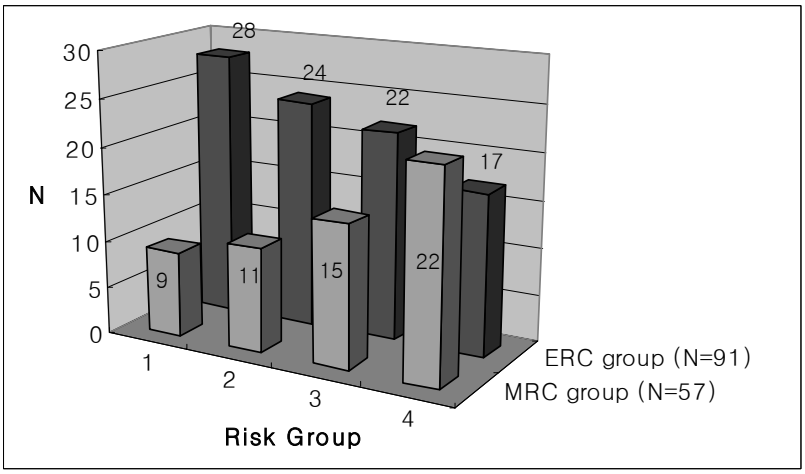
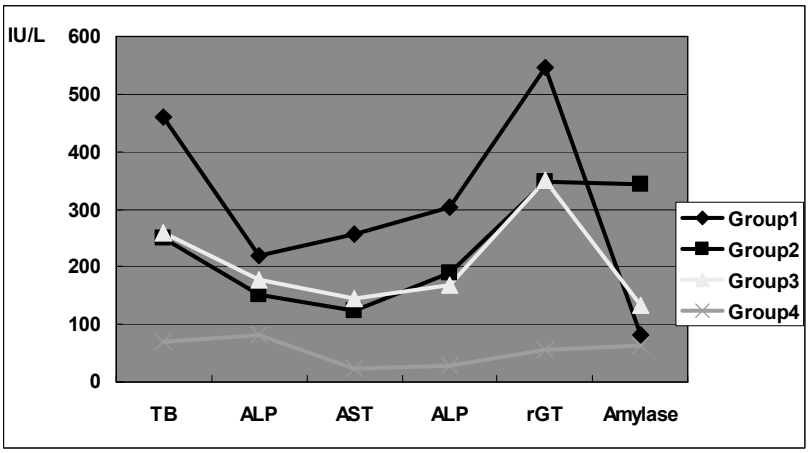


Figure 3. Serum chemistry data in each risk group



	TB	ALP	AST	ALT	rGT	Amylase
Group 1 vs 2	< 0.05	NS	< 0.05	NS	NS	< 0.05
Group 1 vs 3	< 0.05	NS	< 0.05	< 0.05	NS	NS
Group 1 vs 4	< 0.05	NS	< 0.05	< 0.05	NS	NS
Group 2 vs 3	NS	NS	NS	NS	NS	< 0.05
Group 2 vs 4	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Group 3 vs 4	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	NS

NS; not significant, TB: total bilirubin

Figure 4. Incidence of CBD stones in each group

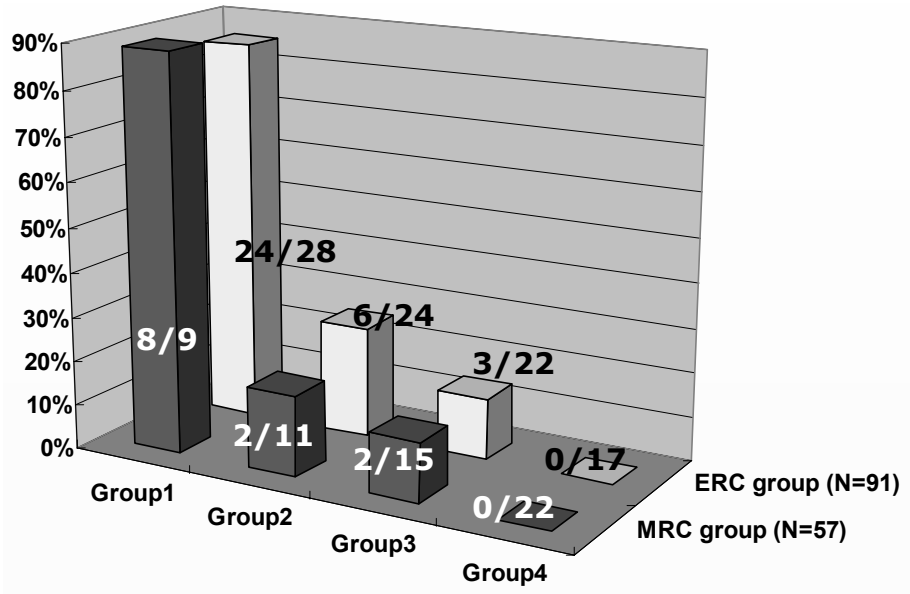


Table 2. The rate of purely diagnostic ERC in each risk group and modality group

Purely diagnostic ERC	MRC group	ERC group	Total
risk group 1 (n=37)	0 (0)	2 (7.1)	2 (5.4)
risk group 2 (n=35)	1 (9.1)	9 (37.5)	10 (28.6)
risk group 3 (n=37)	3 (20.0)	12 (54.5)	15 (40.5)
risk group 4 (n=39)	1 (4.5)	12 (70.6)	13 (33.3)
total (n=148)	5 (8.8)	35(38.5)	40 (27.0)

Note- Numbers in parentheses are percentages.

VI. DISCUSSION

Many authors have reported on the accuracy of a MRC for the diagnosis of CBD stones. Although the reported accuracy of a MRC varies widely [6-15], recent studies using a breath-hold single-shot half-Fourier sequence and a phased-array multicoil present high sensitivity ranging from 92-100%, comparable to that of direct cholangiography[8,16,17]. In spite of having a high accuracy, a MRC is purely a diagnostic tool contrary to an ERC; therefore, establishment of an appropriate indication for the use of MRC is necessary in consideration of cost-effectiveness.

Currently, most physicians and radiologists agree to reduce the diagnostic use of an ERC, but there is no consensus on the indications for the use of a MRC. Some authors recommend the use of a MRC for only moderate risk group[7,9,15] and others recommend for both high and moderate risk groups[8,13].

We previously reported the accuracy of MRC according to clinical risk groups in symptomatic gallstones[8]. In the study, patients were divided into three groups with a high, moderate, and low risk for CBD stones and we suggested the use of a MRC not only in the moderate risk group but also in the high risk group because CBD stones were not identified in 30% of the high risk group and the frequency of a diagnostic ERC was not ignorable.

In the present study, we modified the criteria for risk groups suggested by Liu et al.[9] in which patients were classified

into four groups, namely extremely high, high, moderate, and low risk groups. Liu's criteria are similar to the criteria generally used but different in that patients with acute biliary pancreatitis or resolving choledocholithiasis are classified into either a moderate or high risk group rather than an extremely high risk group. Liu's criteria are reasonable because the incidence of choledocholithiasis has been reported to be low in patients with acute biliary pancreatitis, which presumably is due to the early passage of gallstones[18,19]. The difference between our criteria in the current study to that of Liu et al. is that we defined the upper limit of normal CBD diameter as 6 mm. They used 5mm as the upper normal limit because the patients involved in their study were relatively young (mean age-36.8 years), however, the mean age of the patients in our study was 54.7 years, so we used the generally accepted standard[20-24]. If we had used 5mm as the upper normal limit, difference in the incidence of a CBD stone between Group 2 and Group 3 might be smaller.

In the present study, the incidence of a CBD stone was 86.5% in the very high risk group (Group1) and 0% in the low risk group (Group4). Because the rate of a purely diagnostic ERC was acceptably low (5.4%) in the very high-risk group (Group1), it would be optimal to perform an ERC without intervening with a MRC in this group. Meanwhile, the incidence of a purely diagnostic ERC was relatively higher in the ERC group with 'high' and 'moderate' risks as compared to the MRC group with similar risks. Therefore, we suggest that MRC should be

recommended first in these high and moderate risk groups. Our data suggests that neither a MRC nor an ERC should be indicated in a low risk group.

In Liu's study[9], they performed an IOC on all the patients except on risk group 4, and an IOC had identified a CBD stone in only one of 26 patients with a negative MRC among group 2 patients. Perissat[25] and Thornton[26] reported that performing a LC without a routine IOC does not result in significant problems related to retained stones because only 0.3 - 0.4 % of patients without preoperative bile duct imaging (ERC or IOC) presented postoperatively with symptomatic duct stones. In our study, 12 patients in Group 2 and 3 who showed a negative result in the preoperative MRC did not undergo an ERC or an IOC and none of them presented recurred CBD stones in the follow-up period. However, among the patients with a negative MRC, two patients presented newly developed laboratory abnormalities and biliary obstructive symptoms after the MRC, so they underwent an ERC, which showed CBD stones. In our opinion, an IOC might be unessential for Group 2 and 3 patients who showed no CBD stone in a MRC, however, additional studies may be necessary for the patients who show a negative MRC but present newly developing symptoms or laboratory abnormalities.

In the current study, CBD stones were not detected in the low risk group (Group 4) and there were no cases of morbidity due to retained stones in the follow-up period. Hence, preoperative bile duct imaging could be omissible in low risk

groups and a MRC is recommended only if necessary.

The limitation of this study is that the choice of the ERC or the MRC was not randomized because of the retrospective design of this study. Because the selection of diagnostic modality was decided by clinicians' preference or subjective confidence for the presence of a CBD stone, the ERC was more frequently used in the higher risk groups and the MRC was more frequently used in the lower risk groups. We can expect that the rate of a purely diagnostic ERC might have been higher if this study were a randomized study.

V. CONCLUSION

In conclusion, our criteria modification of risk group selection could effectively predict CBD stones in gallstone patients. By using a MRC preferentially before a LC in patients who have a moderate or high risk of CBD stones, the purely diagnostic use of an ERC can be significantly reduced.

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ABSTRACT (IN KOREAN)

담낭절제술 전 담관결석 진단검사의 선택

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김영진

연구목적: 담석증 환자에서 수술 전에 동반된 담관결석을 정확히 진단하기 위한 검사방법으로 내시경역행담관조영술 (ERC) 과 자기공명담관조영술 (MRC) 등이 사용되고 있으나 적절한 선택 기준이 아직 정립되어있지 않아 검사 선택에 도움이 되는 임상적 기준을 확립하고자 하였다.

연구대상 및 방법: 1999년 1월부터 2002년 7월까지 담석증으로 복강경하 담낭절제술을 받은 환자들 중 수술 전에 MRC나 ERC를 시행한 148명의 환자들을 MRC군 (MRC를 먼저 시행하고 필요한 경우 ERC를 시행한 환자)과 ERC군 (ERC를 우선적으로 시행한 환자)으로 후향적으로 분류하고 각각을 담관결석의 위험도에 따라 네 단계의 위험군 (제 1군-최고도, 제 2군- 고도, 제 3군- 중등도, 제 4군- 저위험군)으로 분류하였다. 분류한 MRC군과 ERC군의 임상소견, 생화학검사소견, 담관결석 동반율, ERC가 진단적으로만 사용된 빈도 등을 통계적으로 비교하였다. 또한 각각의 담관결석 위험군에 따른 담관결석 동반율과 수술 후 추적관찰기간 중 담관결석의 재발율을 비교하여 사용된 위험군 분류기준이 적절한가

고찰하고 위험군에 따라 어떤 검사방법이 적절한지 평가하였다.

연구결과: ERC군과 MRC군의 나이, 성별, 생화학검사 소견은 유의한 차이가 없었으며 담관결석의 빈도는 ERC군에서 36.3%, MRC군에서 21.1%였으나 두 군 간에 각 위험군 별 담관결석의 빈도는 유사하였다. MRC군 (n=57) 중 31명 (54%)은 MRC에서 담관결석이 없는 것으로 진단받고 더 이상의 검사 없이 복강경하 담낭절제술을 받았다. 나머지 MRC군 환자들은 ERC를 추가로 시행 받았는데 이중 2명에서 담관결석이 발견되었고, 5명 (9%)은 담관결석은 없었으나 내시경적 괄약근 절개술을 받았으며, 따라서 ERC가 단순히 진단 목적으로만 사용된 경우는 8.8% (n=5)였다. ERC군 (n=91)에서는 33명 (36%)에서 ERC 상 담관결석이 발견되어 내시경적으로 제거하였고, 49명 (54%)에서는 담관결석이 발견되지 않았으며, 기술적으로 ERC를 실패한 경우가 9명 (10%) 이었다. ERC군에서 ERC가 단순히 진단적인 목적으로만 사용된 경우는 38.5% (n=35)로 MRC군에 비해 현저히 높았다. 위험군에 따른 담관결석의 빈도는 제 1군 (최고도)에서 86.5%, 제 2군 (고도)에서 22.9%, 제 3군 (중등도)에서 13.5%, 제 4군 (저위험군)에서 0%였다. 담낭절제술 후 2명에서 담관결석이 재발하였는데 이들은 모두 ERC군이었으며 MRC군에서는 재발한 경우가 없었다.

결론: 복강경하 담낭절제술을 시행하기 전에 담관결석의 중등도 또는 고도 위험군에서는 MRC를 우선적으로 사용함으로써 ERC가 진단 목적으로만 사용되는 경우를 줄일 수 있을 것이다.

핵심되는 말 : 자기공명담관조영술, 내시경역행담관조영술, 담석증, 담관결석, 복강경하 담낭절제술