Prospective study of scoring system in selective intraoperative cholangiography during laparoscopic cholecystectomy

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AIM: To evaluate of scoring system in predicting choledocholithiasis in selective intraoperative cholangiography (IOC) during laparoscopic cholecystectomy (LC).

METHODS: The scoring system of predicting choledocholithiasis was developed in a retrospective study in 264 cases, and was tested in 184 to evaluate its predictive value in choledocholithiasis.

RESULTS: The scoring system was developed in a retrospective study of 264 cases, the statistical analyses showed the predictive factors included sex, transaminase levels, alkaline phosphatase level, bilirubin level, and common bile duct diameter on ultrasonography. The scoring system was used in 184 cases prospectively, of which, 3 of 162 (1.9%) cases scoring $\geq 3$ had choledocholithiasis, 17 of 22 (77.3%) cases scores $\geq 3$ had choledocholithiasis. A case of scores$\geq 3$ or more prospectively should be considered highly intraoperative cholangiography during laparoscopic cholecystectomy.

CONCLUSION: The scoring system can predict choledocholithiasis and is helpful in selection patients for intraoperative cholangiography.

Prospective study

From January 2000 to June 2001, the scoring system was carried out prospectively in 184 patients undergoing LC. Following evaluation, LC and IOC were performed, then the correlation of scoring results with choledocholithiasis was studied.

RESULTS

No choledocholithiasis in 264 patients undergoing LC was discovered by ultrasonography prior to operation. During LC, IOC found choledocholithiasis in 54 patients (Table 1).

Table 1 Factors predicting choledocholithiasis in 264 patients

| Factor            | No of cases with choledocholithiasis (54 cases) | No of cases without choledocholithiasis (210 cases) | Percentage (%) | P    |
|-------------------|-----------------------------------------------|----------------------------------------------------|----------------|------|
| Sex               |                                               |                                                    |                |      |
| Male              | 27                                             | 40                                                 | 40             | <0.05|
| Female            | 27                                             | 170                                                | 14             |      |
| Age               |                                               |                                                    |                |      |
| $<55ys$           | 20                                             | 98                                                 | 23             | <0.05|
| $\geq 55ys$       | 15                                             | 30                                                 | 17             | >0.05|
| Pancreatitis      |                                               |                                                    |                |      |
| Present           | 15                                             | 30                                                 | 33             | >0.05|
| Absent            | 39                                             | 180                                                | 18             |      |
| Jaundice          |                                               |                                                    |                |      |
| Present           | 10                                             | 22                                                 | 21             | >0.05|
| Absent            | 44                                             | 188                                                | 19             |      |
| Transaminase      |                                               |                                                    |                |      |
| Normal            | 31                                             | 201                                                | 13             |      |
| Elevated          | 23                                             | 9                                                   | 72             | <0.05|
| Alkaline phosphatase |                                             |                                                    |                |      |
| Normal            | 36                                             | 189                                                | 16             |      |
| Elevated          | 18                                             | 21                                                 | 46             | <0.05|
| Bilirubin         |                                               |                                                    |                |      |
| Normal            | 31                                             | 205                                                | 13             |      |
| Elevated          | 23                                             | 5                                                   | 82             | <0.05|
| CBD diameter on US|                                               |                                                    |                |      |
| $\leq 8$ mm       | 33                                             | 204                                                | 14             |      |
| $>8$ mm           | 21                                             | 6                                                   | 78             | <0.05|
Multivariate analysis found that independent predictors of choledocholithiasis included sex, serum level of transaminase, alkaline phosphatase, and bilirubin, and CBD diameter on US. Therefore, the scoring system in regression analysis was established (Table 2).

### Table 2: Scoring system of predicting choledocholithiasis

| Factor            | Criteria     | Score |
|-------------------|--------------|-------|
| Sex               | Female       | 0     |
|                   | Male         | 1     |
| Transaminase      | Normal       | 0     |
|                   | Elevated     | 2     |
| Alkaline phosphatase | Normal       | 0     |
|                   | Elevated     | 2     |
| Bilirubin         | Normal       | 0     |
|                   | Elevated     | 3     |
| CBD diameter on US| ≤8 mm        | 0     |
|                   | >8 mm        | 3     |
| Total             |              | 11    |

The scoring system was used in 184 patients undergoing LC before operation. During LC, all of the patients were performed IOC (Table 3).

### Table 3: Results of scores in 184 patients before LC

| Score | No of patients with choledocholithiasis | No of patients without choledocholithiasis | Percentage |
|-------|----------------------------------------|--------------------------------------------|------------|
| <3    | 17                                     | 159                                        | 1.9        |
| ≥3    | 3                                      | 5                                           | 77.3       |

A significant difference in predicting value scoring 3 or more and that of less than 3 was found according to the χ² test. Thus, evaluation of LC patient with scoring system preoperatively would be helpful in predicting choledocholithiasis. If patients were scored more than 3, IOC should be performed during LC.

### DISCUSSION

With the popularization of laparoscope, the age of microtraumatic surgery has come and great changes have occurred in surgical operation and surgical ideology[22]. Gallstone is one of the common primary diseases of biliary tract. LC has become a conventional method to treat patient with symptomatic gallstones. IOC is one of the accurate and safe procedure used in LC, is helpful in finding abnormality of pancreaticobiliary tract[31], avoiding common bile duct injury[42-48], and detecting choledocholithiasis[9-11], thus, some recommended a routine IOC during LC[4,5,12]. Because majority of gallstones patients do not have choledocholithiasis, IOC will increase the patient’s cost and exposure to X-ray, however, some researches found that the value of IOC were limited[13-15] it is unnecessary to perform a routine IOC during LC. However, there are still 10-15 % of cholecystolithiasis patients who have choledocholithiasis[16]. Preoperative ERCP and IOC may be helpful to find choledocholithiasis[17-20].

Mahmud suggested that, some gallstones might slip into the cystic duct or the common bile duct during LC, and IOC is valuable of determining the choledocholithiasis, ERCP and EST were regarded as effective methods detecting choledocholithiasis[21]. Edye retrospectively analyzed 31 patients with choledocholithiasis treated by EST, and ERCP showed completely cleared common bile duct, but IOC during subsequent LC revealed common duct residual stones in 8 of these 31 patients. The author suggested that even after presumed endoscopic clearance of the bile duct stone, many patients (26 %) still harbored stones in common bile duct at the time of cholecystectomy. Therefore IOC during LC was recommended even after successful ERCP[22]. Some studies revealed that preoperative ultrasonograph is neither sensitive nor specific for detecting common bile duct dilatation or the presence of residual stones[23]. Some studies assessed the use of endoscopic retrograde cholangiopancreatography (ERCP), IOC, intraoperative laparoscopic ultrasonography (IOUS)[24-27]. Bege manifested that combined endoscopic and laparoscopic management of cholecystolithiasis and choledocholithiasis were a viable option and were optimized by endoscopic ultrasonography[28]. The combined procedures of endoscopic sphincterotomy and LC included one-stage treatment of cholelithiasis and choledocholithiasis, elimination of potential return to the operating room when postoperative ERCP were unsuccessful[29,30]. Ichihara concluded that intraoperative real time cholangiograms were helpful in detecting bile duct injuries or anomalies, and unsuspected bile duct stones[31].

We recommend that IOC during LC should be performed selectively. Digital C-arm can provide real-time imaging and obtain a clear cholangiogram easily. The protocol of selective IOC is still debatable. Snow analyzed the results of 2034 LC, and found that there were no false negative, bile duct injuries, or other complications attributable to routine IOC or selective IOC, and suggested that selective IOC were an effective method of verifying suspected choledocholithiasis and were safer and less expensive than routine IOC[32]. Abboud performed a meta-analysis of published data to evaluate preoperative indicators of choledocholithiasis, which included cholangitis, jaundice, dilated CBD on ultrasound, hyperbilirubinemia, elevated levels of alkaline phosphatase, pancreatitis, cholecystitis, and hyperamylasemia. The results showed that these predictors could be applied as guidelines for whether to investigate for duct stones before cholecystectomy[33]. Kim also suggested selective IOC, and the risk levels of the presence of choledocholithiasis were determined by the independent predictor including preoperative clinical, biochemical and sonographic variables[34]. However, Koo reviewed 420 cases of elective LC, IOC was routinely performed and acted as the reference standard for the presence of choledocholithiasis, and found that there were no predictive tests that could sufficiently increase an observer’s probability estimate of the presence or absence of choledocholithiasis to allow for “selective” IOC decisions[35].

By logistic regression analysis, our studies showed that sex, transaminase levels, alkaline phosphatase level, bilirubin level and common bile duct diameter on ultrasonography were independent predictors of choledocholithiasis. A scoring system was therefore designed with a total score of 11. Our prospective studies also showed that patients scoring more than 3 were at significant risk to have choledocholithiasis, and IOC should be performed during LC.
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Edited by Ren SY