



Contents lists available at ScienceDirect

The American Journal of Surgery

journal homepage: www.americanjournalofsurgery.com

The southwestern surgical congress multi-center trial on suspected common duct stones

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ARTICLE INFO

Article history:

Received 12 March 2018

Received in revised form

15 October 2018

Accepted 29 December 2018

Presented at the Southwestern Surgical Congress Annual Meeting, Napa Valley, California, April 2018.

Keywords:

Cholelithiasis

ERCP

MRCP

Common duct exploration

ABSTRACT

Background: Choledocholithiasis is present in up to 15% of cholecystectomy patients. Treatment can be surgical, endoscopic, or via interventional radiology. We hypothesized significant heterogeneity between hospitals exists in the approach to suspected common duct stones.

Methods: A retrospective review of patients that had a preoperative MRCP, endoscopic ultrasound, endoscopic retrograde cholangiopancreatogram (ERCP), or intra-operative cholangiogram was performed. Comparisons were by Wilcoxon-Mann-Whitney tests with significance of $p < 0.05$ for paired variables and $p < 0.017$ for multiple comparisons.

Results: Twelve participating institutions identified 1263 patients (409 men and 854 women) with a median age of 49 years (IQR: 31–94). Liver function tests (LFT's) were elevated in 939 patients (75%), median bilirubin level 1.75 mg/dl (IQR: 0.8–3.7 mg/dl) and median common duct size 7 mm (IQR 5–10 mm). The most common initial procedure was cholecystectomy with IOC at seven institutions, endoscopy at four and MRCP at one.

Conclusion: Significant variation exists within the surgical community regarding suspected common duct stones. These results underscore the need for a protocol for common duct stones to minimize multiple, redundant interventions.

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Introduction

During the era of open cholecystectomy, common duct stones were most often identified by intra-operative cholangiography (IOC), and if identified, open common bile duct exploration (CBDE) ensued. Additional preoperative imaging of the common duct was

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performed infrequently. Endoscopic retrograde pancreaticholangiography (ERCP) was reserved for patients with retained common duct stones after prior CBDE. In the early 1990's, laparoscopic cholecystectomy replaced the open approach.^{1,2} Due to the technical challenges of laparoscopic CBDE, ERCP with endoscopic sphincterotomy (ES) became the procedure of choice for common duct stones.³ Coinciding with this time frame, magnetic resonance imaging of the common duct (MRCP) and endoscopic ultrasound (EUS) were developed as additional options for imaging stones in the common duct. With multiple options for diagnosis and treatment, varied approaches were adopted at different institutions for patients with suspected common duct stones undergoing laparoscopic cholecystectomy.

In 2002, a National Institute of Health (NIH) thirteen member panel representing the fields of gastroenterology, hepatology, clinical epidemiology, oncology, biostatistics, surgery, health services research, radiology, internal medicine, and the public met to provide recommendations for appropriate use of endoscopic retrograde cholangiopancreatography (ERCP) for diagnosis and treatment of common duct stones.⁴ They performed a systematic review of the literature and received presentations by experts. Among their conclusions pertaining to choledocholithiasis:

- MRCP, EUS, and ERCP have comparable sensitivity and specificity in the diagnosis of choledocholithiasis.
- Patients undergoing cholecystectomy do not require preoperative ERCP if the risk of choledocholithiasis is low.
- Laparoscopic CBDE and postoperative ERCP are both safe and reliable in clearing common duct stones.

The NIH guidelines helped define safe practices, but provided little clarity for a best practice recommendation. Best practice guidelines and enhanced recovery pathways have recently been developed for a growing number of surgical conditions. These protocols demonstrate shorter length of stay and lower morbidity compared to standard practice. There are over 750,000 laparoscopic cholecystectomies performed in the United States each year, and approximately 15% of these patients will have common duct stones.⁵ This represents an opportunity to improve clinical outcomes for many patients, while potentially reducing unnecessary healthcare expenditure. The Southwestern Surgical Congress Multi-Center Trial Group hypothesized that varied clinical approaches remain in the surgical community. We performed this review to gain an understanding of the diversity of practice at multiple member institutions. This data would potentially reinforce the need for widespread adoption of a protocol directed approach to suspected choledocholithiasis.

Methods

The Southwestern Surgical Congress Multicenter Trial Group was organized in 2015 to collaboratively evaluate surgical diseases and treatments. Twelve institutions participated in a retrospective review of patients having cholecystectomy with suspected common duct stones. Patients were included if they underwent preoperative imaging of the common duct by EUS, ERCP, or MRCP, or had an IOC performed for clinical indications. Patients having IOC on a "routine" basis were not included. Routine cholangiography was defined as an intraoperative cholangiogram performed in the absence of clinical indicators of choledocholithiasis. Patient demographics, peak bilirubin, liver function test (LFT) elevation, common duct size, type of initial intervention, interval to intervention and length of stay were analyzed. LFT elevation was defined as alanine transaminase, aspartate aminotransferase, and alkaline phosphatase level greater than normal. Initial intervention was

grouped by performance <24 h or >24 h. Continuous variables were reported as means (+/– S.D.) and not normally distributed data was reported as medians (interquartile range). Comparisons of groups was performed by Wilcoxon-Mann-Whitney tests with significance of $p < 0.05$ for paired variables and $p < 0.017$ for multiple comparisons using SAS[®] statistical software. These p values were chosen based upon the number of individual comparisons analyzed.

Results

Data were submitted from twelve participating institutions. The participating institutions were all referral centers with availability of endoscopic and interventional radiology resources at their disposal. There were 409 men and 854 women with a median age of 49 years (IQR: 31–94). Liver function tests (LFT's) were elevated in 939 patients (75%). Median bilirubin level was 1.75 mg/dl (IQ: 0.8–3.7 mg/dl) and median common duct size was 7 mm (IQR 5–10 mm). There was considerable variation in approach between institutions (Table 1). Laparoscopic cholecystectomy with IOC was the most frequent initial intervention at 7 institutions, endoscopy at 4 institutions, and MRCP at one. Median interval to initial intervention ranged from 6 to 56 h. Second interventions varied between institutions and occurred in 43–100% of patients. A total of 878 patients had an intraoperative cholangiogram. Common duct exploration was performed in 27 patients (2.1%), of which 24 were laparoscopic and three were open. Two hundred seventy-four patients had an initial laparoscopic cholecystectomy with IOC followed by ERCP.

When analyzing initial intervention of the collective data, median length of stay following surgery was 3.0 days (IQR: 2.0–5.0), endoscopy was 4.0 days (IQR: 3.0–5.0), and MRCP 4.0 days (IQR: 3.0–6.0). Median length of stay was significantly shorter for patients initially treated by surgery when compared to endoscopy ($p < 0.0001$) and MRCP ($p < 0.0001$). Median length of stay was significantly shorter for endoscopy than MRCP ($p < 0.0036$). Median length of stay based upon interval to initial intervention at less than 24 h was 3 days (IQR 2–5 days) and greater than 24 h was 4 days (IQR 2–6 days) ($p = 0.14$). Multivariate analysis was utilized to determine if there was a relationship between interval to initial intervention, initial intervention, and length of stay. A significant difference was noted between surgery and endoscopy ($p < 0.0008$) and surgery and MRCP ($p < 0.0001$). In multivariate analysis, there was not a significant difference between endoscopy and MRCP.

Discussion

Approximately 15% of patients that have laparoscopic cholecystectomy also have common duct stones. Several clinical risk factors have been identified which help to predict which patients may have common duct stones. These include elevated bilirubin, dilated common duct size, increase in LFT's, pancreatitis, and advanced age.^{6–8} Some authors recommend additional preoperative imaging in patients with risk factors to determine if preoperative clearance of the common duct by ERCP/ES is required. Mo et al. described 247 patients that had preoperative ERCP for suspected common duct stones.⁹ Clearance of the common duct occurred in 94% of patients. Morbidity occurred in 5% and was self-limiting. They concluded that this approach is safe and effective. Alkhaffaf et al. countered however that the majority of preoperative ERCP's produce negative findings, and a small number of patients experience significant morbidity that could be avoided.¹⁰ They described preoperative ERCP as frequently unnecessary and potentially hazardous.

MRCP was introduced as a "noninvasive" test for choledocholithiasis in the late 1990's.¹¹ Advocates of this modality not

Table 1
Initial intervention and interval to intervention.

Institution	#	Chole/IOC # (%)	Endoscopy # (%)	MRCP # (%)	CBDE # (%)	Initial Intervention
						Median Interval to Intervention (hours)
1	34	15 (44)	7 (21)	12(35)	0	29
2	234	136 (58)	34 (15)	57(24)	6 (3)	26
3	117	45 (38)	57 (49)	5 (4)	10(9)	24
4	50	9 (18)	13 (26)	28(56)	0	15
5	56	17 (30)	30 (54)	6 (11)	2 (3)	22
6	56	15 (28)	39 (70)	0	1 (1)	44
7	66	30 (45)	19 (29)	15(24)	2 (2)	6
8	274	207(75)	29 (11)	38(14)	0	56
9	35	21 (60)	2 (6)	10(28)	2 (6)	18
10	114	34 (30)	51 (45)	26(23)	3 (2)l	14
11	131	81 (62)	50 (38)	0	0	24
12	96	73 (76)	14 (15)	8 (8)	1 (1)	19

only quote a sensitivity of 94% but tout the added anatomic information provided of the pancreas, gall bladder and biliary tree.¹² Sirinek et al. reported an increase in preoperative MRCP from 0.9% to 8.6% between 2004 and 2013. Coinciding with this was a decrease in the use of preoperative ERCP and IOC.¹³ Although MRCP carries a high accuracy and low morbidity, it is limited to diagnosis only and has no therapeutic benefit for common duct stones.

Since the NIH guidelines of 2002 did not recommend a best practice algorithm, institutions have adopted varied approaches to the management of suspected common duct stones. Some authors favor preoperative MRCP, and cite increased safety of this approach.^{14,15} Endoscopy as the initial diagnostic procedure has other proponents.¹⁶ Preoperative endoscopic management ensures the common duct is cleared prior to surgery. This approach avoids the rare but unfortunate sequence of laparoscopic cholecystectomy/IOC, failed ERCP, followed by CBDE. Other authors have advocated a cholecystectomy first approach for patients with intermediate risk of common duct stones.¹⁷ A survey of 390 surgeons in Australia demonstrated there was no clear common pattern for management of choledocholithiasis.¹⁸

The diversity of approach to patients with suspected common duct stones was confirmed by our multi-center study. Seven of the twelve institutions performed laparoscopic cholecystectomy with IOC as the most common initial procedure. But four institutions utilized endoscopy first and one used MRCP. While each of these approaches has been deemed to be safe in the literature, there is not consensus as to what approach is the most cost effective and leads to shorter length of stay.

In addition, there was significant variability in time from admission to initial intervention between institutions. Multiple factors can contribute to these delays including admission to a non-surgical service, limited access to the operative suite, poorly responsive consulting services, and patient comorbidities that must be addressed preoperatively. Cubas et al. reported earlier treatment and shorter length of stay in patients with cholecystitis and appendicitis admitted to a newly developed acute care surgery service.¹⁹ The new model translated to better outcomes and cost savings. Other authors confirm shorter hospital stay and a decreased complication rate in patients with cholecystitis treated on an acute care surgery service.^{20,21} Studies have demonstrated early intervention in acute cholecystitis produced a lower conversion rate to an open procedure, shorter operative time and reduced hospitalization.²² Although our comparison of initial intervention in less than 24 h vs greater than 24 h did not reach significance, prompt intervention following stabilization and evaluation of the patient appears prudent.

There were significant differences in median length of stay when choice of initial intervention was compared. A surgery first

approach resulted in a one day reduction of median length of stay compared to either endoscopy or MRCP. While endoscopy and MRCP had similar median lengths of stay, statistical analysis favored endoscopy in the comparison of these modalities. These results would be anticipated intuitively when one considers that clinical indicators of common duct stones only predict the actual presence of stones in the common duct in 30–50% of patients. Therefore, in at least half of the patients, preoperative imaging of the common duct by endoscopy and/or MRCP produce negative results and “delayed” definitive therapy. Patients that had a surgery first approach that had a negative IOC could be dismissed after postoperative recovery and avoid a second intervention. Those with a positive IOC could be treated by CBDE or ERCP/ES postoperatively.

An interesting additional finding of the multi-center trial was the infrequency of common duct exploration. Collectively, CBDE was performed in only 2.1% of patients. If laparoscopic CBDE could be performed reliably and safely, it would be the most efficient approach as patients could have both the cholecystectomy and CBDE performed in a single surgical procedure. Quaresima et al. reported 384 patients treated by laparoscopic CBDE over 23 years.²³ 214 patients had a transcystic duct approach and 170 patients were explored via choledochotomy. Major morbidity was 3% and 6% respectively and common duct clearance was successful in 95% of patients. Several other studies have documented the safety and effectiveness of laparoscopic common bile duct exploration.^{24,25} Despite this, a recent survey of 750 surgeons from the United States found that 86% chose preoperative ERCP in patients with choledocholithiasis found preoperatively and 70% chose post-operative ERCP for those found by IOC.²⁶ The pendulum for management of common duct stones has clearly swung toward endoscopic management, but perhaps it is time for surgeons to recapture the treatment of common duct stones surgically.

The limitations of our study include the retrospective nature of the study design. In addition, since the treatment selections were left up to clinical judgment, there is the potential for selection bias in the choice of initial intervention for these patients. Moving forward, the participating institutions have agreed to adopt a protocolized approach that was described last year.²⁷ Our plan is to compare our results after initiation of the protocol to our current MCT results.

Conclusions

In summary, the authors acknowledge that our current approach to the patient with suspected choledocholithiasis is varied and would benefit from a standardized protocol. CBDE is currently utilized infrequently. The surgery first approach proved to be the most efficient approach in this review.

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