Routine surveillance cholangiography after percutaneous cholecystostomy delays drain removal and cholecystectomy

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INTRODUCTION: Percutaneous cholecystostomy (PC) is often performed for patients with acute cholecystitis who are at high risk for operative morbidity and mortality. However, the necessity for routine cholangiography after PC remains unclear. We hypothesized that routine surveillance cholangiography (RSC) after PC would provide no benefit compared to on-demand cholangiography (ODC) triggered by signs or symptoms of biliary pathology.

METHODS: We performed a 3-year retrospective cohort analysis of patients managed with PC for acute cholecystitis at two tertiary care hospitals. Patients who had routine surveillance cholangiography (RSC, n = 43) were compared to patients who had on-demand cholangiography (ODC, n = 41) triggered by recurrent biliary disease.

RESULTS: RSC and ODC groups were similar by severity of acute cholecystitis, presence of gallstones, systemic inflammatory response syndrome (SIRS) criteria at the time of PC, SIRS criteria 72 hours after PC, and hospital length of stay. Two patients in the ODC group developed clinical indications for cholangiography. All 44 RSC patients had cholangiography, and 67 total cholangiograms were performed in this group. Surveillance cholangiography identified six patients (14%) with cystic duct filling defect and seven patients (16%) with a common bile duct filling defect, all of whom were asymptomatic. Fifteen patients (35%) in the RSC group had 32 ERCP procedures; five patients (12%) in the ODC group had 7 ERCPs ($p = 0.021$). The ODC group had fewer days to drain removal (35 vs. 61, $p < 0.001$) and days to cholecystectomy (39 vs. 81, $p = 0.005$). Rates of recurrent cholecystitis, cholangitis, gallstone pancreatitis, drain removal, and cholecystectomy were similar between groups.

CONCLUSION: RSC after PC for acute cholecystitis identified biliary pathology in asymptomatic patients and propagated further testing, but did not provide clinical benefit. ODC was associated with earlier drain removal, earlier cholecystectomy, and decreased resource utilization. (*J Trauma Acute Care Surg.* 2017;82: 351–355. Copyright © 2016 Wolters Kluwer Health, Inc. All rights reserved.)

LEVEL OF EVIDENCE: Prognostic study, level III; therapeutic study, level IV.

KEY WORDS: Percutaneous cholecystostomy; cholangiography; cholangiogram; surveillance; recurrent cholecystitis.

When patients with acute cholecystitis are too ill to tolerate an operation, they may be managed by percutaneous cholecystostomy (PC) tube placement to decompress the biliary tree. Although PC has no apparent survival advantage over cholecystectomy, it does provide temporizing therapy while the patient recovers from an acute insult.[1–3] Management of the PC tube remains controversial; decisions regarding drain management vary widely across institutions.[4–8] In particular, the diagnostic and therapeutic yield of performing surveillance cholangiography by injecting contrast through the PC tube is unclear.

It seems likely that routine surveillance cholangiography (RSC) after PC tube placement would identify aberrant anatomy and potentially injurious stones within the biliary tree, and may therefore facilitate procedural intervention before the development of complications like recurrent cholecystitis, cholangitis, and pancreatitis. In theory, a patient with a PC tube in place has already had an acute disease of the biliary tree and may be at increased risk for additional complications. Indeed, Granlund et al.[7] performed cholangiography on 51 patients with acute cholecystitis and identified choledocholithiasis in 16%. However, the clinical significance of such findings is unclear. Collins et al.[9] observed that asymptomatic choledocholithiasis after cholecystectomy may be less consequential than once thought.

The purpose of this study was to establish optimal utilization of cholangiography after percutaneous cholecystostomy for acute cholecystitis by comparing patients who had RSC to those who underwent on-demand cholangiography (ODC) after developing signs or symptoms of biliary disease. We hypothesized that RSC after PC would identify patients with asymptomatic choledocholithiasis, but would provide no benefit in salient clinical outcomes.

METHODS

We conducted a retrospective cohort analysis of 84 consecutive patients managed with PC for acute cholecystitis at the University of Florida Health Shands Hospital or the Malcom Randall Veterans Affairs Medical Center during a 42-month period ending November 1, 2014. We included adult patients (age ≥ 18 years) meeting the TG13 Tokyo definition of acute cholecystitis (right upper quadrant mass, pain, or tenderness along with fever, leukocytosis, elevated C-reactive protein, or imaging findings characteristic of acute cholecystitis).[10] Patients transferred from outside institutions after endoscopic, radiographic, or surgical interventions on the biliary tree were excluded. Inpatient deaths were excluded so that the entire study population would be eligible for outpatient cholangiography.

Data was collected by retrospective review of the electronic medical record. Severity of acute cholecystitis was defined by TG13 Tokyo guidelines.[10] Recurrent cholecystitis was defined as a new episode of acute cholecystitis occurring after a 48-hour period in which the patient was off antibiotics and did not meet systemic inflammatory response syndrome criteria.[11] PC was performed by the transhepatic or transperitoneal route and was guided by computed tomography or ultrasound imaging. Decisions regarding cholangiography after PC and the

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timing of drain removal were at the discretion of the attending surgeon and interventional radiologist. All clinic and procedure notes for each patient were reviewed for a minimum of 1 year after PC.

Statistical analysis was performed using SPSS (version 23; IBM, Armonk, NY). One-way analysis of variance was used to compare normally distributed continuous variables, the Kruskal-Wallis test was used to compare non-normally distributed continuous variables, and Fisher's exact test was used to compare discrete variables. Data were reported as mean ± standard deviation (SD), n (%), or median [interquartile range (IQR)] as appropriate. Significance was set at $\alpha = 0.05$.

RESULTS

Baseline comorbidities, severity of illness, improvement after PC tube placement, and hospital length of stay were similar between RSC and ODC groups (Table 1). All 43 patients in RSC group were asymptomatic when they had their first cholangiogram. However, contrast did not reach the common bile duct in four patients (9%), and common bile duct filling defects were identified in six patients (14%) (Table 2). Fourteen patients (33%) had repeat cholangiography, and 67 total cholangiograms were performed in this group. RSC identified six patients (14%) with cystic duct filling defects and seven patients (16%) with common bile duct filling defects. Fifteen patients in the RSC group went on to undergo 32 total endoscopic retrograde cholangiopancreatography (ERCP) procedures, and 6 of these 15 patients had endoscopic stone extraction.

TABLE 1. Patient Characteristics During Initial Hospitalization for Acute Cholecystitis

	RSC n = 43	ODC n = 41	*p*
Age, y	68 ± 15	70 ± 17	0.695
Male	28 (65%)	29 (71%)	0.644
Charlson comorbidity index	4.1 ± 2.3	4.2 ± 2.5	0.953
Admitted for acute cholecystitis	30 (70%)	33 (81%)	0.317
Calculous cholecystitis	38 (88%)	31 (76%)	0.160
TG13 severity grade	1.8 ± 0.7	1.9 ± 0.7	0.567
Days from admission to PC	2 [1–4]	2 [1–5]	0.568
At the time of PC			
Temperature, °C	37.4 ± 0.6	37.3 ± 0.7	0.468
Heart rate	96 ± 19	94 ± 16	0.570
Respiratory rate	21 ± 4	21 ± 4	0.681
White blood cell count, $\times 10^3/\mu L$	15.5 ± 7.9	14.9 ± 6.9	0.712
Vasopressor infusion	3 (7%)	3 (7%)	0.976
72 h after PC			
Temperature (°C)	37.0 ± 0.5	37.2 ± 0.6	0.273
Heart rate	79 ± 14	84 ± 12	0.150
Respiratory rate	18 ± 3	18 ± 3	0.888
White blood cell count, $\times 10^3/\mu L$	9.4 ± 5.1	10.7 ± 6.6	0.448
Vasopressor infusion	0	0	
Hospital length of stay, d	8 [5–10]	6 [4–18]	0.812

Data are reported as mean ± standard deviation, n (%), or median [interquartile range].
RSC, routine surveillance cholangiography; ODC, on-demand cholangiography; TG13, revised Tokyo Guidelines; PC, percutaneous cholecystostomy.

TABLE 2. Diagnostic Findings for Patients Who Underwent Routine Surveillance Cholangiography (RSC) Versus On-Demand Cholangiography (ODC)

	RSC n = 43	ODC n = 41	*p*
Patients who had a cholangiogram	43 (100%)	2 (5%)	<0.001*
Total cholangiograms in each group	67	2	<0.001*
Days from PC to 1st cholangiogram	44 [30–60]	16 [15–16]	0.032*
Tube dislodgement on 1st cholangiogram	9 (21%)	1 (50%)	0.399
Tube dislodgement on any cholangiogram	9 (21%)	1 (50%)	0.399
Cystic duct occlusion on 1st cholangiogram	4 (9%)	0	0.651
Cystic duct occlusion on any cholangiogram	6 (14%)	0	0.570
CBD filling defect on 1st cholangiogram	6 (14%)	1 (50%)	0.290
CBD filling defect on any cholangiogram	7 (16%)	1 (50%)	0.327
Patients who had ERCP	15 (35%)	5 (12%)	0.021*
Total ERCP in each group	32	7	0.004*
Days from PC to 1st ERCP	73 [3–119]	146 [78–598]	0.142
Stone removal on 1st ERCP	5 (33%)	4 (80%)	0.127
Stone removal on any ERCP	6 (40%)	4 (80%)	0.303

*denotes statistical significance as p value is <0.05.
Data are reported as n (%) or median [interquartile range].
PC, percutaneous cholecystostomy; CBD, common bile duct; ERCP, endoscopic retrograde cholangiopancreatography.

Among 41 patients in the ODC group, 35 patients (85%) returned for a follow-up visit. A single cholangiogram was performed for two patients (5%) who presented with recurrent acute cholecystitis (Table 2). In one case, cholangiography demonstrated that the drain had been dislodged from the gallbladder into the peritoneal space. This patient underwent laparoscopic cholecystectomy without complication. The other patient had a common bile duct defect filling defect, improved with antibiotic therapy, and left the hospital against medical advice. In the ODC group, five patients underwent seven total ERCP procedures, significantly fewer than the RSC group. The RSC group had a significantly shorter interval between PC and drain removal (Table 3) and shorter interval between PC and cholecystectomy (Table 4). There were more patients who never had their drain removed in the RSC group, though this difference did not reach statistical significance. There were no significant differences in rates of recurrent cholecystitis, choledocholithiasis, cholangitis, gallstone pancreatitis, or cholecystectomy between groups. Of the 14 total deaths within 1 year of PC, the cause of death was known in 11, and none of these deaths were caused by biliary disease.

DISCUSSION

Symptom-triggered ODC was associated with earlier drain removal, earlier cholecystectomy, decreased resource utilization, and no adverse outcomes when compared to RSC. The validity of these findings was supported by uniformity between the two groups of patients when considering their initial episode of acute cholecystitis and initial hospital course. These similar baseline characteristics also suggest that the decision for RSC was arbitrarily based on the preferences of surgical and radiology teams, rather than individual patient risk stratification. As would be expected for an apparently unnecessary screening test,

RSC frequently identified asymptomatic patients with incidental pathologic findings and propagated further diagnostic testing with repeat cholangiography and ERCP. However, the lack of clear benefit for this cohort supports the notion that more diagnostic information is not helpful if it does not translate to a therapeutic advantage.

Incidental choledocholithiasis is relatively common. Collins et al.[9] performed a prospective study including 46 patients with asymptomatic choledocholithiasis found on intraoperative cholangiogram during laparoscopic cholecystectomy. The common bile duct was not manipulated, and the cholangiography catheter was left in place with plans for repeat cholangiogram and ERCP with stone extraction 6 weeks later. During the 6-week period, there were two isolated episodes of abdominal pain and no cases of cholangitis.[9] When repeat cholangiogram and ERCP were performed at 6 weeks, nearly three out of four of patients had persistent choledocholithiasis.[9] Several authors have reported that about 5% to 15% of patients undergoing laparoscopic cholecystectomy for uncomplicated symptomatic cholecystitis have common bile duct stones.[12–14]

Surveillance cholangiography seems even more ineffectual in the setting of acalculous cholecystitis. Some clinicians may justify ongoing suspicion for gallstone-related complications after PC for acute acalculous cholecystitis based on the fact that right upper quadrant ultrasound is only 84% sensitive (95% confidence interval 76–92%) in detecting cholelithiasis, such that a substantial proportion of patients diagnosed with acalculous cholecystitis do in fact have gallstones.[15] Regardless, many authors consider PC to be a definitive therapy for patients with acalculous cholecystitis[4,16–18] because of low rates or recurrent cholecystitis. Conversely, about one in four patients with acute calculous cholecystitis may develop recurrent cholecystitis within 2 to 3 months of PCT placement.[3,5,7,19–22]

Notably, longer duration of PC tube drainage is also a risk factor for recurrent cholecystitis.[23] Longer duration of PCT drainage has also been associated with increasing rates of readmission for gallstone-related complications.[24,25] Although delayed drain removal among the surveillance cholangiogram group was not associated with increased incidence of recurrent cholecystitis in our study, it is feasible that prolonged PC tube drainage may represent more than an inconvenience for the patient.

The primary limitations of this study are its retrospective design and the possibility that it was underpowered to detect differences in outcomes between groups. For our purposes, retrospective analysis of a 3-year experience at two different institutions was the most practical way to obtain sample sizes large enough to make meaningful comparisons. Although including patients from two different hospitals likely increased variability in management strategies, it was our intention that the study population reflected discrepancies in practice patterns across institutions. Future studies should seek to define the optimal timing of drain removal after a period during which cholangiography is performed only if the patient develops signs or symptoms of biliary disease. Capping the PC tube before drain removal may be prudent in this setting.

TABLE 3. Drain Removal for Patients Who Underwent Routine Surveillance Cholangiography (RSC) Versus On-Demand Cholangiography (ODC)

	RSC n = 43	ODC n = 41	*p*
Accidental drain dislodgement	13 (30%)	11 (27%)	0.810
Drain removal based on clinical judgment	3 (7%)	5 (12%)	0.483
Drain removal after cholangiography	7 (16%)	1 (2%)	0.058
Drain removal during cholecystectomy	14 (33%)	14 (34%)	0.877
Days from PC to drain removal	61 [43–101]	35 [15–61]	<0.001*
No drain removal	6 (14%)	10 (24%)	0.279

Data are reported as n (%) or median [interquartile range].
PC, percutaneous cholangiography.

TABLE 4. Outcomes for Patients Who Underwent Routine Surveillance Cholangiography (RSC) Versus On-Demand Cholangiography (ODC)

	RSC n = 43	ODC n = 41	*p*
Recurrent acute cholecystitis	5 (12%)	5 (12%)	0.936
Days from PC to recurrent cholecystitis	73 [63–264]	39 [15–75]	0.222
Choledocholithiasis	8 (19%)	5 (12%)	0.549
Cholangitis	3 (7%)	0	0.241
Gallstone pancreatitis	1 (2%)	0	0.965
Days from PC to choledocholithiasis, cholangitis, or gallstone pancreatitis	69 [3–280]	146 [78–598]	0.222
Cholecystectomy	17 (40%)	16 (39%)	0.962
Laparoscopic	10 (59%)	5 (31%)	0.166
Open or converted to open	7 (41%)	11 (69%)	0.166
Days from PC to cholecystectomy	81 [57–169]	39 [16–80]	0.005*
One-year mortality	6 (14%)	8 (20%)	0.566

Data reported as n (%) or median [interquartile range].
PC, percutaneous cholecystostomy.

CONCLUSIONS

RSC after PC for acute cholecystitis identified asymptomatic patients with incidental findings of abnormal biliary tree drainage, propagating repeat cholangiography, and ERCP. However, this approach did not decrease rates of recurrent cholecystitis, cholangitis, or gallstone pancreatitis. Patients managed with ODC had fewer ERCPs, earlier drain removal, and earlier cholecystectomy. These findings support symptom-triggered RSC after PC for acute cholecystitis to expedite care and decrease unnecessary resource utilization.

AUTHORSHIP

T.J.L., C.G.D., and A.M.M. contributed to literature review, study design, and article composition. T.J.L. and C.G.D. contributed to data collection and analysis. S.C.B., F.A.M., G.A.S., W.J.Z., J.R.J., C.A.C., R.S.S., P.A.E., and A.M.M. contributed to data interpretation and provided critical revisions.

DISCLOSURE

The authors declare no conflicts of interest.

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