

The role of intraoperative cholangiography in patients undergoing laparoscopic cholecystectomy for acute gallstone pancreatitis: is magnetic resonance cholangiopancreatography needed?

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ABSTRACT

INTRODUCTION Intraoperative cholangiography is sporadically used in patients undergoing laparoscopic cholecystectomy to delineate common bile duct anatomy and exclude retained stones. In patients with acute gallstone pancreatitis, intraoperative cholangiography may reduce the need for preoperative magnetic resonance cholangiopancreatography.

MATERIALS AND METHODS A retrospective review of a prospectively collected patient database was undertaken over a 15-year period. The primary objective was to evaluate intraoperative assessment of the common bile duct with intraoperative cholangiography in patients with acute gallstone pancreatitis.

RESULTS A total of 2215 patients underwent laparoscopic cholecystectomy between October 1998 and December 2013; 113 patients (of whom 77 were women) with a mean age of 54 years (range 16–88 years) were diagnosed with acute gallstone pancreatitis. Of these, 102 patients (90%) underwent laparoscopic cholecystectomy with intraoperative cholangiography, which was normal in 89 cases. Thirteen patients had choledocholithiasis on intraoperative cholangiography, 11 of whom were managed with concomitant trans-cystic duct exploration and clearance. Two patients required postoperative endoscopic retrograde cholangiopancreatography.

CONCLUSIONS In patients diagnosed with acute gallstone pancreatitis, it is reasonable to proceed directly to surgery using intraoperative cholangiography on the same admission as the definitive assessment of the common bile duct. This negates the need for magnetic resonance cholangiopancreatography and can translate into cost savings and reduced length of stay.

KEYWORDS

Gallstone – Pancreatitis – Intraoperative cholangiography – Magnetic resonance cholangiopancreatography – Cholecystectomy

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Introduction

Gallstones are the most common cause of acute pancreatitis globally.^{1–5} Following its introduction in the 1980s, laparoscopic cholecystectomy has become the favoured management of cholelithiasis.⁴ Over 66,000 cholecystectomies are performed in the UK every year, making it one of the most common surgical procedures.⁵

Acute gallstone pancreatitis is the result of ampullary obstruction by distal common bile duct stones, as first described in 1901 by Opie.⁶ Despite the majority of these stones traversing the ampulla spontaneously, approximately 20% of cases fail to do so.⁷ Appropriate

management of gallstone pancreatitis therefore relies on the correct diagnosis, clearance and prevention of further choledocholithiasis.^{8,9}

If there is evidence of common bile duct obstruction and/or cholangitis on the initial ultrasound, the International Association of Pancreatology (IPA) and American Pancreatic Association (APA) guidelines recommend endoscopic retrograde cholangiopancreatography (ERCP) to clear the duct. However, in the absence of ultrasound-proven common bile duct stones, a magnetic resonance cholangiopancreatography (MRCP) is often undertaken to further assess the common bile duct. MRCP is non-invasive and low risk. However, it lacks the immediate therapeutic

options afforded by ERCP and/or intraoperative cholangiography and has a poor sensitivity for detection of small stones less than 4 mm.¹⁰ Furthermore, as detected common bile duct stones may pass spontaneously, arranging an MRCP often delays the treatment pathway.¹¹ These delays may impede NHS trusts from meeting the current British Society of Gastroenterology target of performing laparoscopic cholecystectomy within two weeks of presentation in patients with mild to moderate gallstone pancreatitis.¹²

Intraoperative cholangiography has been shown to be sensitive and specific at detecting common bile duct stones as well as safely delineating biliary anatomy.¹⁵ A positive intraoperative cholangiography enables the surgeon to perform an immediate common bile duct exploration, stone clearance and laparoscopic cholecystectomy in a single procedure, thereby reducing lengthy time delays from unnecessary MRCP and supporting hospital trusts in meeting the above targets.

Currently, no robust UK-based guidelines exist to dictate the optimal assessment and management of the common bile duct in patients following acute gallstone pancreatitis. Management is often surgeon and centre dependent and remains the subject of much debate, with a wide variation in the use of either intraoperative cholangiography or laparoscopic ultrasound and MRCP prevailing.^{14,15}

The aim of this study was to evaluate intraoperative assessment of the common bile duct with intraoperative cholangiography in patients with acute gallstone pancreatitis.

Materials and methods

A retrospective study was undertaken of all patients undergoing laparoscopic cholecystectomy at St James' University Hospital, Leeds, over a 15-year period between October 1998 and December 2013.

All patients with a diagnosis of gallstone pancreatitis who underwent laparoscopic cholecystectomy were included in the study. Patients who underwent a preoperative ERCP were excluded from further analysis as choledocholithiasis had already been established and treated.

Gallstone pancreatitis was diagnosed on the basis of clinical presentation (abdominal pain), transabdominal ultrasonography and biochemical markers (serum amylase over three times the upper limit, raised ALT suggesting a biliary cause).

Fitness for surgery was assessed by the presence of minimal comorbidities, no previous intra-abdominal surgery, normalising liver function tests and a peak C-reactive protein level of less than 200 mg/l, chosen as per author experience.

Laparoscopic cholecystectomy was performed using a standardised four-port approach using a 10-mm epigastric port and two 5-mm right upper quadrant ports. No patient underwent intraoperative ultrasound. In cases where gallstones were identified in the common bile duct, an attempt was made to remove them transcystically using a Dormia® basket.

Our practice was to perform laparoscopic cholecystectomy in patients with gallstone-induced pancreatitis in the following circumstances: mild/moderate gallstone pancreatitis, normalising liver function tests (LFTs) or improving inflammatory markers. An intraoperative cholangiography was also undertaken routinely when possible.

Data extraction

Data extraction was performed by authors AT, SP and TP. Patient demographics, biochemical markers, ultrasound reports, intraoperative details, MRCP results, intraoperative cholangiography results and length of stay were recorded. The time interval between diagnosis of pancreatitis and the date of laparoscopic cholecystectomy was also recorded.

Statistical analysis

Statistical analysis was performed using Prism version 6.0c (GraphPad Software, La Jolla, California). The Mann-Whitney U test was used to compare continuous data; a *P*-value of less than 0.05 was considered statistically significant.

Results

A total of 2215 patients underwent laparoscopic cholecystectomy in the 15-year period. Of these, 113 patients were diagnosed with acute gallstone pancreatitis (of whom 77 were women), with a mean age of 54 years (range 16–88 years). Eleven patients had no intraoperative cholangiography performed either due to the unavailability of a radiographer or because of technical issues. The median time interval between the date of diagnosis of acute gallstone pancreatitis and laparoscopic cholecystectomy was five days (range 0–21 days).

A total of 102 patients underwent an intraoperative cholangiography. In 89 cases (87%), this was found to be normal. Thirteen patients were found to have choledocholithiasis at the time of laparoscopic cholecystectomy. Eleven of these patients were managed successfully via concomitant common bile duct exploration while the remaining two patients underwent a postoperative ERCP.

Of the 36 patients who underwent a preoperative MRCP, 12 of them were shown to have choledocholithiasis. At surgery, 11 of these patients were found to have a clear duct. Four of the 24 patients with normal preoperative MRCP findings were shown to have choledocholithiasis on intraoperative cholangiography.

Of note, the median time interval between MRCP results and laparoscopic cholecystectomy was four days (range 2–17 days). Patients who underwent a preoperative MRCP had a greater wait for laparoscopic cholecystectomy (median 4 days, range 3–21 days) when compared with patients who did not have a preoperative MRCP (median 4 days, range 0–7 days; *P* < 0.0001). The median follow-up time was 5.8 years (range 0.9–15.8 years). No patient had another episode of gallstone pancreatitis or developed obstructive jaundice secondary to stones postoperatively and no readmissions were recorded. A summary of the results is shown in Table 1.

Table 1 Summary of results

Factor	Patients	
	(n)	Range
Total gallstone pancreatitis	113	
Total intraoperative cholangiography	102	
Normal	89	
Abnormal	13	
Successful common bile duct exploration	11	
Postoperative ERCP	2	
Preoperative MRCP	32	
Median time delay to laparoscopic cholecystectomy	5 days	0–21 days
Median follow-up time	5.8 years	0.9–15.8 years
Mean length of stay	4.7 days	0–21 days

Discussion

Gallstone pancreatitis is a common presentation across the emergency surgical intake and in patients with mild to moderate gallstone pancreatitis, laparoscopic cholecystectomy within two weeks is recommended.² The predicament, however, lies in the wide variation in management algorithms across the UK, ranging from the routine use of preoperative MRCP to proceeding directly to laparoscopic cholecystectomy with imaging of the common bile duct performed by laparoscopic ultrasound or intraoperative cholangiography.

This study aimed to evaluate the outcomes of patients who underwent laparoscopic cholecystectomy for acute gallstone pancreatitis to determine whether intraoperative cholangiography could potentially reduce the need for a preoperative MRCP in the majority of cases.

Of 102 patients with gallstone pancreatitis who underwent intraoperative cholangiography, only 13 were found to have choledocholithiasis. This was successfully managed by transcystic common bile duct exploration in nearly all cases (11/13) with postoperative ERCP being performed in only two remaining cases. Moreover, patients undergoing intraoperative cholangiography had a shorter waiting time to laparoscopic cholecystectomy than those who instead underwent MRCP (median 4 days vs 7 days). No patient represented with sequelae of choledocholithiasis on follow-up, demonstrating that the routine use of intraoperative cholangiography is a reliable method of identifying common bile duct stones.

A comparison of the MRCP and subsequent intraoperative cholangiography findings in this study, demonstrate that the majority of patients with choledocholithiasis on MRCP will have passed spontaneously by the time a

laparoscopic cholecystectomy is performed. Several patients would therefore have undergone an unnecessary preoperative ERCP. Conversely, a normal MRCP was not shown to negate the need for common bile duct imaging at the time of laparoscopic cholecystectomy. We found four patients with a normal preoperative MRCP to have choledocholithiasis during intraoperative cholangiography.

Intraoperative imaging modalities such as intraoperative cholangiography or ultrasound are crucial in ensuring that patients are not at risk of subsequent pancreatitis due to retained stones.¹⁶ The chief benefit of intraoperative cholangiography and intraoperative ultrasound over MRCP lies in its ability to enable common bile duct imaging precisely at the time of laparoscopic cholecystectomy.

Patient management can be delayed by performing an MRCP prior to laparoscopic cholecystectomy, adding time and cost, or by performing a preoperative ERCP, adding time, cost and the risks associated with an additional invasive procedure. The operative time-consuming nature of intraoperative cholangiography has often been criticised in the literature and a careful preoperative assessment of the biliary tree has been advocated instead.^{17–19} In our experience, an intraoperative cholangiography typically adds only a minimum of 10–15 minutes of operative time as it is routinely performed on all patients. Consequently, surgeon, operative team and radiographers are prepared for an intraoperative cholangiography during each laparoscopic cholecystectomy performed.

Importantly, we have replicated the findings of other centres. Intraoperative cholangiography has been reported to exhibit a higher diagnostic accuracy at detecting choledocholithiasis compared with MRCP (98% vs 85%),¹⁷ while Richard *et al* concluded that there was no place for preoperative MRCP in patients with suspected choledocholithiasis due to the unacceptably elevated rate of false negative results compared with intraoperative cholangiography.²⁰ Ueno *et al* evaluated the use of intraoperative cholangiography and concluded that it played an important role in identifying choledocholithiasis and delineating biliary tree abnormalities in patients who have previously had an MRCP.²¹

However, contrasting evidence is also present in the literature. Several studies advocate the use of MRCP in diagnosing choledocholithiasis in gallstone pancreatitis,^{22–24} with a sensitivity and specificity reported as 97.98% and 84.4%, respectively, by Shammugam *et al*,¹⁸ and 82.6% and 97.5%, respectively, by De Waele *et al*.²⁵ Clearly, variation in management of patients with gallstone pancreatitis exists and there remains a crucial need to establish robust standards for the management of these patients.

The IAP/APA Guidelines, the UK Working Party on Acute Pancreatitis Guidelines and the more recent PONCHO trial in 2015 recommend that a cholecystectomy be performed preferably on the index admission following mild gallstone pancreatitis, and certainly within the next two weeks.^{2,26,27} There is therefore a clear benefit in meeting these targets and bypassing MRCP, and consequently reducing preoperative waiting time. It should also be noted that the IAP/APA Guidelines also state that MRCP is generally not indicated

in patients with mild biliary pancreatitis without clinical evidence of common bile duct obstruction, and advocate early laparoscopic cholecystectomy with intraoperative cholangiography.²

Our study is mainly limited by its retrospective nature. The current medical literature contains few prospective studies comparing intraoperative cholangiography and MRCP in the diagnosis of acute gallstone pancreatitis.^{19,22} Thus, there remains a need for future prospective research in this field. In addition, because of our practice of rarely performing a preoperative MRCP before laparoscopic cholecystectomy, we do not have large numbers on which to base our conclusions regarding MRCP. This is likely to bias our time-to-treatment measures. However, our findings are well supported by other studies in the literature.^{9,21,26,28}

Finally, although our study does not include a detailed analysis of cost, there are inevitable and significant savings in not routinely performing an MRCP, due to reduced imaging costs and shorter inpatient stays, as evidenced by Lin *et al.*¹⁴

Conclusion

Our results and long-term follow-up demonstrate that the majority of patients presenting with acute gallstone pancreatitis can be safely and successfully managed with laparoscopic cholecystectomy and intraoperative cholangiography, without requiring a preoperative MRCP. This could ultimately result in cost savings due to shorter inpatient stays and reduced use of MRCP. Intraoperative cholangiography reduces the time between diagnosis of acute gallstone pancreatitis and laparoscopic cholecystectomy, enabling timely surgical management within the recommended guidelines.

References

- Forsmark CE, Baillie J, AGA Institute Clinical Practice and Economics Committee, AGA Institute Governing Board. AGA Institute technical review on acute pancreatitis. *Gastroenterology* 2007; **132**: 2022–2044.
- Working Group IAP/APA Acute Pancreatitis Guidelines. IAP/APA evidence-based guidelines for the management of acute pancreatitis. *Pancreatology* 2013; **13**: e1–e15.
- Kazmierczak SC, Catrou PG, Van Lente F. Enzymatic markers of gallstone-induced pancreatitis identified by ROC curve analysis, discriminant analysis, logistic regression, likelihood ratios, and information theory. *Clin Chem* 1995; **41**(4): 523–531.
- Dubois F, Berthelot G, Levard H. [Cholecystectomy by coelioscopy]. *Presse Med* 1989; **18**: 980–982.
- National Institute for Health and Care Excellence. *Costing Statement: Gallstone Disease. Implementing the NICE Guideline on Gallstone Disease (CG188)*. London: NICE; 2014.
- Opie EL. The etiology of acute hemorrhagic pancreatitis. *J Exp Med* 1901; **12**: 182–188.
- Williams EJ, Green J, Beekingham I *et al.* Guidelines on the management of common bile duct stones (CBDS). *Gut* 2008; **57**: 1004–1021.
- Fan ST, Lai EC, Mok FP *et al.* Early treatment of acute biliary pancreatitis by endoscopic papillotomy. *N Engl J Med* 1993; **328**: 228–232.
- Acosta JM, Ronzano GD, Pellegrini CA. Ampullary obstruction monitoring in acute gallstone pancreatitis: a safe, accurate, and reliable method to detect pancreatic ductal obstruction. *Am J Gastroenterol* 2000; **95**: 122–127.
- Gosset J, Deviere J, Matos C. Magnetic resonance imaging of acute pancreatitis: the pancreatogram. *JOP* 2004; **5**: 48–50.
- Collins C, Maguire D, Ireland A *et al.* A prospective study of common bile duct calculi in patients undergoing laparoscopic cholecystectomy: natural history of choledocholithiasis revisited. *Ann Surg* 2004; **239**(1): 28–33.
- United Kingdom guidelines for the management of acute pancreatitis. *Gut* 1998; **42**: S1–S13.
- Singh G, Gupta PC, Sridar G, Katariya RN. Role of selective intra-operative cholangiography during cholecystectomy. *Aust N Z J Surg* 2000; **70**: 106–109.
- Lin C, Collins JN, Britt RC, Britt LD. Initial cholecystectomy with cholangiography decreases length of stay compared to preoperative MRCP or ERCP in the management of choledocholithiasis. *Am Surg* 2015; **81**(7): 726–731.
- Gilcaja V, Gurusamy KS, Takwoingi Y *et al.* Endoscopic ultrasound versus magnetic resonance cholangiopancreatography for common bile duct stones. *Cochrane Database Syst Rev* 2015; (2): CD011549.
- Jamal KN, Smith H, Ratnasingham K, Siddiqui MR *et al.* Meta-analysis of the diagnostic accuracy of laparoscopic ultrasonography and intraoperative cholangiography in detection of common bile duct stones. *Ann R Coll Surg Engl* 2016; **98**(4): 244–249.
- Tofigh AM, Razmjoie F, Khabbaz A *et al.* Comparing the efficacy of preoperative magnetic resonance cholangiopancreatography with intra-operative cholangiography in patients suspicious to biliary stones. *Gastroenterol Hepatol Bed Bench* 2013; **6**: 80–85.
- Shanmugam V, Beattie GC, Yule SR *et al.* Is magnetic resonance cholangiopancreatography the new gold standard in biliary imaging? *Br J Radiol* 2005; **78**: 888–893.
- Silva AA, Camara CACR, Martins A *et al.* Intraoperative cholangiography during elective laparoscopic cholecystectomy: selective or routine use? *Acta Cir Bras* 2013; **28**: 740–743.
- Richard F, Boustany M, Britt LD. Accuracy of magnetic resonance cholangiopancreatography for diagnosing stones in the common bile duct in patients with abnormal intraoperative cholangiograms. *Am J Surg* 2013; **205**: 371–373.
- Ueno K, Ajiki T, Sawa H *et al.* Role of intraoperative cholangiography in patients whose biliary tree was evaluated preoperatively by magnetic resonance cholangiopancreatography. *World J Surg* 2012; **36**: 2661–2665.
- Hallal AH, Amortegui JD, Jeroukhimov IM *et al.* Magnetic resonance cholangiopancreatography accurately detects common bile duct stones in resolving gallstone pancreatitis. *J Am Coll Surg* 2005; **200**(6): 869–875.
- Mofidi R, Lee AC, Madhavan KK *et al.* The selective use of magnetic resonance cholangiopancreatography in the imaging of the axial biliary tree in patients with acute gallstone pancreatitis. *Pancreatology* 2008; **8**(1): 55–60.
- Hjartarson JH, Hannesson P, Sverrisson I *et al.* The value of magnetic resonance cholangiopancreatography for the exclusion of choledocholithiasis. *Scand J Gastroenterol* 2016. **16**: 1–8.
- De Waele E, Op de Beeck B, De Waele B, Delvaux G. Magnetic resonance cholangiopancreatography in the preoperative assessment of patients with biliary pancreatitis. *Pancreatology* 2007; **7**(4): 347–351.
- Da Costa DW, Bouwense SA, Schepers NJ *et al.* Dutch Pancreatitis Study Group. Same-admission versus interval cholecystectomy for mild gallstone pancreatitis (PONCHO): a multicentre randomised controlled trial. *Lancet* 2015; **386**(10000): 1261–1268.
- UK Working Party on Acute Pancreatitis. UK Guidelines for the management of acute pancreatitis. *Gut* 2005; **54**: 1–9.
- Piacentini F, Perri S, Pietrangeli F *et al.* [Intraoperative cholangiography during laparoscopic cholecystectomy: selective or routine?] *G Chir* 2003; **24**: 123–128.