Laparoscopic management of remnant cystic duct calculi: a retrospective study

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ABSTRACT

INTRODUCTION Even though cholecystectomy relieves symptoms in the majority of cases, a significant percentage suffer from 'post-cholecystectomy syndrome'. Cystic duct/gall bladder remnant calculi is a causative factor. We present our experience with the laparoscopic management of cystic duct remnant calculi.

PATIENTS AND METHODS We managed 15 patients with cystic duct remnant calculi from 1996 to 2007 in our institute. All these patients had earlier undergone laparoscopic subtotal cholecystectomy at our centre. They were successfully managed by laparoscopic excision of the remnant.

RESULTS The mean duration between first and second surgery was 8.35 months (range, 6–10.7 months). The mean operating time was 103.5 min (range, 75–132 min). Duration of hospital stay was 4–12 days. There was a higher incidence of remnant duct calculi following laparoscopic subtotal cholecystectomy than conventional laparoscopic cholecystectomy – 13/310 (4.19%) versus 2/9590 (0.02%). The morbidity was 13.33%, while there were no conversions and no mortality.

CONCLUSIONS Leaving behind a cystic duct stump for too long predisposes stone formation, while dissecting too close to the common bile duct and right hepatic artery in acute inflammatory conditions is dangerous. We believe that the former is a wiser policy to follow, as cystic duct remnant calculi are easier to manage than common bile duct or vessel injury. Laparoscopic excision of the remnant is effective, especially when performed by experienced laparoscopists. 'T'-tube is used to cannulate the common bile duct in case the tissue is friable. Magnetic resonance cholangiopancreatography is the imaging modality of choice, and is mandatory.

KEYWORDS

Laparoscopic subtotal cholecystectomy – Post-cholecystectomy syndrome – Cystic duct remnant calculus – Excision

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There is no doubt that cholecystectomy relieves the symptoms of gall stone disease in as many as 85% of cases.¹ The remaining 7–15% continue to have similar symptoms post-operatively, and is termed the post-cholecystectomy syndrome, which was first described by Womack and Crider in 1947.² The cystic duct remnant calculus is one of the causes of post-cholecystectomy syndrome. Florcken first reported the concept of 'cystic duct remnant' in 1912; since then, many researchers have studied this ambiguous entity with varying theories.³ Laparoscopic surgery for biliary calculi has come a long way, and with it newer modifications such as the subtotal cholecystectomy.⁴ Laparoscopic surgery for the removal of calculi of the cystic duct remnant has rarely been reported.⁵ We present our experience of patients with calculi of the cystic duct remnant that successfully underwent laparoscopic extraction.

Patients and Methods

We managed 15 patients (8 males and 7 females) with cystic duct remnant calculi from 1996 to 2007 in our institute. All these patients had earlier undergone laparoscopic subtotal cholecystectomy (LSC) at our centre. Out of these 15 patients, 3 cases were cirrhotic. The following 'variants' of LSC were performed: (i) LSC I – leaving the posterior wall intact with the liver; (ii) LSC II – dividing the infundibulum circumferentially close to the junction of the gall bladder and cystic duct; and (iii) LSC III – a combination of LSC I and LSC II. The presenting symptoms were jaundice alone in 3 patients, abdominal pain alone in 7 patients, cholangitis (with jaundice fever, and pain) in 2 patients, pruritis associated with the jaundice in 1 patient, and asymptomatic in 2 patients. Routine blood and urine

Figure 1 Ultrasonography showing remnant duct calculus (large arrow), gall bladder fossa (dotted lines) with absent gall bladder, posterior shadowing (small arrows).

Figure 2 Cystic duct remnant (A) and common bile duct (B).

investigations including liver function test, abdominal and chest X-rays, ultrasonography, and magnetic resonance cholangiopancreatography (MRCP) were performed for all patients. Leukocytosis was seen in the two patients with cholangitis. Liver function tests showed an elevated bilirubin in the clinically jaundiced cases, and mildly elevated alkaline phosphatase levels in all cases. Ultrasonography (Fig. 1) identified cystic duct remnant calculus in 9 cases, while MRCP identified calculus in all the patients. There were no patients with common bile duct calculi. Laparoscopic intervention was planned for all the patients after adequate pre-operative preparation. A nasogastric tube was placed in all cases to decompress the stomach to avoid obstruction of the operating field. The operating team position and port placements were similar to those of a standard laparoscopic cholecystectomy, with the addition of

an extra port for the caudal retraction of the stomach. In cirrhotic patients, the trocar for the laparoscope was placed either above or below the umbilicus. The liver was lifted cranially to approach the cholecystohepatic triangle area. Adhesions in the area were dissected out with a combination of sharp and blunt dissection. The cystic duct remnant was identified (Fig. 2), skeletonised and an ultracision scalpel was used to open it. The calculus was then visible (Fig. 3a,b), which was then 'milked' out using gentle pressure at the junction with the common bile duct. After removing the calculus with a stone-holding grasper, a free flow of bile was seen, signifying patency. An infant feeding tube (size 5-Fr) was introduced into the common bile duct via the stump and thorough irrigation with saline was done for all cases. This ensures that any debris in the common bile duct is flushed into the duodenum. Intra-operative cholangiogram was done for all the patients to detect residual calculi. The remnant cystic duct could be completely

Figure 3 (a,b) Calculus exposed after opening the cystic duct remnant (arrow); A, common bile duct.

Figure 4 Suturing after excision of the remnant (arrow); A, common bile duct.

excised in 11 cases, and the common bile duct closed with intracorporeal suturing using 3.0 Vicryl™ (Fig. 4). In the other 4 patients, friable tissue made closure after cystic duct remnant excision impossible, so a 'T'-tube was inserted into the common bile duct via the cystic duct opening. The tube was fixed in place with a purse string suture. The right subhepatic space was drained with a 24-Fr tube in all patients.

Results

From 1996 to 2007, we have performed 9900 laparoscopic cholecystectomies in our institute. Out of these cases, 9590 (96.86%) underwent conventional laparoscopic cholecystectomy and 310 (3.14%) patients underwent some form of LSC, of whom 15 patients developed remnant duct calculi. The indications for which they underwent LSC were: acute cholecystitis with adhesions ($n = 4$), empyema ($n = 5$), mucocoele due to impacted calculus ($n = 1$) and phlegmon ($n = 3$). In other words, LSC was done for patients where the cystic duct–common bile duct junction could not be clearly defined due to the above-mentioned conditions. The other two patients (2 of 9590) that developed remnant duct calculi underwent conventional laparoscopic cholecystectomy. Thus, it is clear from our series that there is a higher incidence of remnant duct calculi following LSC than conventional laparoscopic cholecystectomy – 15 of 310 (4.19%) versus 2 of 9590 (0.02%). Six out of the 15 patients operated in our institute had cirrhotic livers prior to the first surgery. Out of the 15 patients, 6 patients previously underwent LSC I, 6 patients underwent LSC II and 3 patients underwent LSC III. The mean time between first and second surgery was 8.35 months (range, 6–10.7 months). The mean operating time was 103.5 min (range, 75–132 min). The drain tube

was removed after 48 h in patients and after days in cases, and duration of hospital stay was 4–12 days. None of the patients needed a blood transfusion. There were no perioperative complications, no conversions or mortality. A 'T'-tube was inserted in the common bile duct of four patients, as the sutures were placed in friable tissue following excision of the remnant. For these patients, a 'T'-tube cholangiogram was performed on the fifth postoperative day; free flow of contrast into the duodenum was seen and no leak was detected. At this stage, we place the drainage bag at the level of the patient. Because of this position, the bile will drain through the common bile duct as long as there is no distal obstruction. After 3 days, in the absence of leak (confirmed by no bile in the subhepatic drain tube), the bag was lifted and placed above the level of the patient's bed. A further 3 days later in the absence of jaundice, pain and an empty subhepatic drain bag, the patients were discharged with the tube 'cut and tied'. It was removed after 21–27 days, after confirming duct patency with ultrasonography and liver function tests. There were two patients with postoperative complications – one case of obstructive jaundice with bile leak and one case of biliary pancreatitis. The first patient developed postoperative jaundice and right-sided abdominal pain 14 days following surgery. MRCP was performed and revealed a bilioma (70 ml), and a 1-cm calculus in the distal common bile duct. This patient's previous MRCP was reviewed and found to be normal. It may be assumed that part of the stone or an unrecognised second stone may have slipped into the common bile duct during dissection of the cystic duct remnant and rough handling of the stone(s). An ultrasonography-guided aspiration was successfully performed for the bilioma. The patient was subjected to an endoscopic retrograde cholangiogram with sphincterotomy, which retrieved the calculus. A stent was placed *in situ* and subsequently removed after 8 weeks. The second patient developed postoperative biliary pancreatitis, and recovered completely after conservative management. The first follow-up was scheduled at 7 days, the second at 30 days, the third at 90 days and the fourth at 360 days. All patients attended up to the third follow-up, while only four presented for the final follow-up. Pain was relieved for all the patients by the time of first follow-up, jaundice was relieved completely at the second follow-up (as confirmed by serum bilirubin levels) and, thereafter, the patients had no problems.

Discussion

By definition, any length of cystic duct more than or equal to 1 cm remaining following surgery is considered as a cystic duct remnant.⁶ Bodvall and Overgaard⁷ found that a cystic duct remnant larger than 1 cm was present in 67% of patients with common bile duct stones and 82% of patients

with severe postoperative biliary distress. Rozses *et al.*⁸ reported the cause of post-cholecystectomy syndrome to be due to the cystic duct stump syndrome in 16% of patients. Though the exact incidence is not known, cystic duct or gall bladder remnant with or without stones seems to be emerging as one of the leading causes of post-cholecystectomy syndrome, especially in this era of minimally invasive surgery where subtotal cholecystectomy has started gaining popularity.^{9,10} In our series, the incidence of cystic duct remnant calculus in cases who underwent LSC was 4.19%, and 0.02% in patients who underwent conventional laparoscopic cholecystectomy. Does the incidence of cystic duct remnant calculi increase following laparoscopic cholecystectomy when compared to the open technique?¹¹ This question remains unanswered so far. According to Cuschieri's grading system, grade III and IV gall bladders seem to at higher risk as the distorted biliary anatomy misleads the inexperienced surgeon, leading to this syndrome in as many as 17–25% of cases.¹² In our experience, patients with cystic ducts which run parallel to the common bile duct have a low insertion, and are at high risk of being divided closer to the gall bladder–cystic duct junction. In the era of minimally invasive surgery, it is likely that inexperienced surgeons tend to be over-enthusiastic to avoid injury to the common bile duct at the cost of leaving behind too long a cystic duct. Incompletely removed gall bladders or inadvertently left out cystic duct remnants significantly add to the morbidity. Ultrasonography was only 60% accurate in our series, while MRCP was 92% accurate, and so seems to be the best diagnostic modality. It is prudent to evaluate the entire biliary tree radiologically to avoid missing any other conditions like common bile duct calculus. Keiler *et al.*,¹⁵ in their intra-venous cholangiography study of 113 post-cholecystectomy patients, found that > 65% patients had a > 1 cm cystic duct left *in situ*, rendering them at risk of developing post-cholecystectomy syndrome. Hence, they advised the routine use of intra-operative cholangiography to reduce the incidence, as have others.¹⁴ It has been postulated that the length of the ideal cystic duct stump should be just under 0.5 cm; in other words, the cystic duct should be cut very close to the common bile duct.¹⁵ Some authors recommend the removal of the entire cystic duct along with the gall bladder at the time of cholecystectomy itself to produce better outcomes.¹⁶ Once the patient has been diagnosed with remnant cystic duct stones, surgical excision should be undertaken to avoid potentially life-threatening complications, such as carcinoma, recurrent cholangitis, mucocoele, recurrent cholelithiasis with gross dilatation of remnant, and Mirrizi syndrome.^{17,18} Other modalities like ERCP with basket, laser/electrohydraulic or mechanical lithotripter over a guide wire, cholangioscopy, ESWL with or without endoscopic removal of fragmented stones, and transcutaneous Fogarty balloon catheter deployment have been successfully

tried in an attempt to remove stones in these remnants as an alternative to surgery.^{19–22} These procedures are particularly helpful when the patient is unfit for surgery, provided the expertise is available. Traditionally, the open technique was considered as the procedure of choice for tackling these cystic duct remnant stones. Later, the laparoscopic approach became popular, though only attempted in advanced centres. Minilaparotomy incisions were used to remove such cystic remnants, as laparoscopic intervention was thought to be a risky endeavour in view of local scarring of the area.²³ As in other surgical disciplines, minimally invasive surgery has revolutionised the management protocol of these patients, subject to availability of expertise. Many experts have successfully excised the cystic duct remnant laparoscopically, thus, leading to full recovery of the patient without significant postoperative morbidity.^{24,25} Though the techniques of LSC were standardized in our institute initially for cirrhotic patients, we have gradually incorporated it for the so-called 'difficult' cholecystectomies even in non-cirrhotic patients.²⁶

Finally, the all-important question – how do we prevent remnant duct calculi? Recommendations include:

1. *Correct identification of the gall bladder–cystic duct junction.*
2. *Milking of cystic duct towards the gall bladder before clipping it.*
3. *Removal of impacted calculus from neck or cystic duct and observe free flow of normal bile.*
4. *Cystic duct stump should not be more than 0.5 cm long.*²⁷
5. *Transfixation of cystic duct stump, if indicated, should be done only with absorbable suture material.*
6. *Intra-operative cholangiography as a routine for all patients without acute inflammation.*²⁸
7. *Look for the long cystic duct running parallel to the common bile duct with a low insertion.*

In our institute, the consensus is not to attempt excessive 'blind' dissection in acute inflammatory situations, as cystic duct remnant pathology is easier to handle rather than the risk of a bile duct or vascular injury. Moreover, we believe that the LSC is very useful procedure in complicated gall bladder disease, and has served us well in difficult pathological situations. We do not perform intra-operative cholangiography in all patients, and certainly not in the difficult cases. Also, the postoperative management of the 'T'-tube is our own method, and is effective even though it has not been scientifically researched.

Conclusions

It seems that cystic duct remnant calculi are more common in patients who undergo LSC, where the infundibulum or

an excess length of cystic duct is left behind. The type of LSC did not influence the postoperative complications. MRCP is the imaging modality of choice, and is mandatory in all patients during pre-operative assessment. In the hands of an experienced surgeon, these patients can be successfully managed laparoscopically, even though they are technically difficult. Needless to say, this also allows the patients to enjoy all the benefits of minimal access.

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