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ORIGINAL RESEARCH ARTICLE

A tertiary care centre experience of Subtotal Cholecystectomy without Cystic Duct Ligation(Open tract or fenestrative)for difficult Cholecystitis

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ABSTRACT

BACKGROUND: Current descriptions of the history of subtotal cholecystectomy require more details and accuracy. The first cholecystectomy was performed by Carl Langenbuch in the Lazarus hospital of Berlin on 15 July 1882. **AIMS AND OBJECTIVE:** To Study the outcome of Laparoscopic Subtotal cholecystectomy without Cystic Duct Ligation (Open tract or fenestrative) for difficult Cholecystitis**.**

METHODS AND MATERIALS: A Prospective observational study was conducted in the department of General surgery, IQ City Medical College and Hospital, Durgapur with patients of 25 to 60 years of age, posted for laparoscopic cholecystectomy between January 2015 to December 2022, with per-operative finding of difficultanatomy, where critical view of safety was not achieved after 30 minutes of laparoscopic procedure. **RESULT** In our study, 36 (21.05%) patients with bile leak, 9 (5.26%) were prolonged beyond 2 weeks, out of which further 4 settled down soon on their own, but rest 5 with deranged LFT not. So, ERCP and CBD stenting was arranged for them, which settled down the bile leak in them.

CONCLU SION:

Opened tract or fenestrative laparoscopic subtotal

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cholecystectomy (LSTC without is a relatively cystic duct ligation) straightforward, easy, safe and effective alternative to open conversion when dissection of Calot's triangle is hazardous.

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KEYWORDS:

Gall bladder, Difficulty cholecystectomy, Laparoscopic subtotal cholecystectomy, Critical view of safety

Introduction: Soon after its introduction in 1985, laparoscopic cholecystectomy has replaced open cholecystectomy as the surgical procedure of choice for symptomatic gallstones. Whichever approach is used, standard cholecystectomy requires safe dissection of the structures in Calot's area, displaying the critical view of safety. This is rendered difficult in the presence of severe acute and/or chronic inflammation, cirrhosis with portal hypertension[1] deforming the hepatocystic triangle anatomy or making the area too friable to work upon safely, with associated higher rates of bile duct injury[2-4]. The traditional response to a difficult laparoscopic cholecystectomy is conversion to an open procedure, but this may result in increased postoperative pain, delayed mobility, prolonged hospital stay, adhesion formation and incisional hernia. In addition, a dissection that is difficult laparoscopically is often equally difficult at open operation, with unsatisfactory visualization of structures and conversion does not guarantee the avoidance of inadvertent biliary or vascular injury.

Under these conditions, secure ductal identification by the critical view of safety (CVS) may be very challenging because CVS requires clearing of the inflamed hepatocystic triangle in order to demonstrate the cystic duct, cystic artery, and the cystic plate. The infundibular technique, in which the funnel-shaped infundibular-cystic duct junction is the rationale for identification, is relatively much easier to achieve. However, chronic biliary inflammation causing dense

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fibrosis, contraction and fusion can make the common bile duct pulled up , too close to gall bladder neck and any attempt at probing into the gall bladder side opening and applying an inside purse string suture from mucosal aspect around the probe can potentially injure or narrow the pulled up CHD/CBD.[4] So, when the CVS has not been achieved after a reasonable trial of dissection, the surgeon is more likely to realize that conditions are too difficult to proceed in the usual manner and opt for a different approach before a biliary injury occurs. So in such situations, possible bail out technique and procedures should be safe as well as effectively therapeutic. Safety implies prevention of biliary, significant vascular or any adjacent structure injury. At the same time, it is also desirable to be therapeutically effective, so that patient should not suffer from the residual disease any further and require another procedure. Otherwise the surgeon will betempted to push on with a risky dissection in the hepatocystic triangle in order to avoid a second procedure, causing biliary or vascular injury or perform a cholecystostomy, which will usually necessitate a second operation.

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Possible Bail out procedures in difficult cases:

- Cholecystostomy
- Fundectomy
- Partial cholecystectomy (Leaving behind grossly obvious gall bladdersac)
- Subtotal cholecystectomy

Here, cholecystostomy leaves the almost entire gall bladder with only temporary relief of stone burden and pain/inflammation. 2nd and 3rd methods allow the surgeon to complete the procedure in hand and salvage the patient with temporary relief, but leave him/her with a gall bladder remnant. In 1966, Bodvall and Overgaard[6] defined “gallbladder remnant” as a wider part of the free end of the cystic duct that gives the appearance of a diminutive gallbladder.[6] The functional remnant gallbladder may communicate with the remainder of the biliary tree just as the parent gallbladder does. Stones can form or be retained within these remnants and may cause recurrent biliary colic and all of the usual complications of cholecystolithiasis. Bodvall and Overgaard[6] attributed the first report of clinically significant complications of gallbladder remnants after

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cholecystectomy to Florken in 1912,[7] and summarized literature to 1966. The subject was reviewed again in 2009 by Pernice and Andreoli.[8] A brief summary of the literature, which is mostly composed of small case series or case reports, is that gallbladder remnants may become symptomatic and require excision in a second operation at any time from shortly after the initial operation to many years later, that too upon deformed anatomy.

In such cases, subtotal cholecystectomy is considered the best bail-out technique.[2, 20-22] It consists of removing enough portions of the gallbladder safely to possibly obviate the need of future surgery, although all the time, it may not be so.

Development of Subtotal Cholecystectomy:

The idea of less than complete cholecystectomy for the specific purpose of dealing with difficult operative conditions during cholecystectomy was advanced by Estes,[9] of Bethlehem, PA, in 1938. In operations for gangrenous cholecystitis on 25 patients, which he termed partial cholecystectomy, the gallbladder was incised longitudinally and the wall of the gallbladder was excised up to the point that it was attached to the liver. The part attached to the liver itself was left behind and the free cut edge of the gallbladder was over-sewn. The remaining mucosa was treated with iodine. Estes specifically stated that the cystic duct was not sutured or ligated and that no part of the gallbladder was sutured together to produce a closed cystic structure, ie, a gallbladder remnant.[9] Recovery was generally quite smooth and there were no persistent bile fistulas.

Arthur Lerner,[10] of Winnipeg, in 1950 and William McElmoyle,[11] of Victoria, British Columbia, in 1954 described variations of this technique for difficult cholecystectomies and again without producing a closed cystic structure. Lerner described 2 cases of “partial cholecystectomy” in which he resected the free wall of the gallbladder down to the cystic duct. He noted that the cystic artery would be cut within or on the wall of the gallbladder as one trimmed the inferior aspect of the gallbladder wall near the cystic duct and recommended over-sewing the

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wall at that point to occlude the vessel. McElmoyle[11] described and illustrated, in a singularly clear fashion, the principles and technique of this operation when performed specifically for the prevention of bile duct or vascular injury during a difficult cholecystectomy. No attempt is made to dissect the cystic duct or artery when inflammation obscures the neck of the gallbladder. The gallbladder is opened and the redundant portions excised. The cystic duct and the portions of the body, neck, and infundibulum lying above and to the left side are left in situ as a "shield to the vulnerable structures." The cystic duct is not closed; its mucosa is ablated and a drain is placed. McElmoyle[11] reported 23 cases with excellent results and no biliary fistula.

What Estes, Lerner, and McElmoyle all recognized was that a portion of the gallbladder wall should intentionally be left behind as a buffer between the edge of the dissection on the gallbladder and the dangerous hepatocystic triangle.[11] This was the "shield" of McElmoyle, which fulfils a main principle of safety: to stay 1 step away from danger. Bornman and Terblanche[12] clearly described and illustrated a similar operation 30 years later using the name subtotal cholecystectomy, but gave the option of internal suture of the cystic duct or external suture over a probe advanced into the cystic duct from within the gallbladder.

While these authors were describing their techniques, others were presenting a modification in which the lowest portion of the gallbladder was resutured. This step was done to avoid biliary fistula but may also result in the creation of a remnant gallbladder.

Less than Total Cholecystectomy Terminologies development:

Partial excision regarding cholecystectomy per se seems to be a vague term. However, it implies removal of only a part of gall bladder, leaving behind a considerable part of gall bladder sac.

Subtotal Cholecystectomy means removal of almost whole of the sac of gall bladder, however, part of the gall bladder wall will remain, in the form of a miniature sac or without a sac.

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Strasberg, et al., divided subtotal cholecystectomies in “fenestrating” and “reconstituting” types based on, if the remaining portion of the gallbladder was left open or closed. Fenestrating subtotal cholecystectomy can be performed with or without internal suture-closure of the cystic duct. In both types, the gallbladder portion in contact with the liver can be left as such or resected. “Reconstituting” type cholecystectomies are performed in an attempt to avoid biliary fistulas, however they pose a higher risk of new gallstone formation in the remnant gallbladder and are consequently at higher risk of recurrent biliary disease .[13]

Confusion arises with Fenestrating subtotal cholecystectomy, when some surgeons start performing it with internal suture-closure of the cystic duct, which may hold intact like external closure with no biliary leak or may partially open up with consequent biliary leak. However, as it attempts at closure of the cystic duct, it no more can be called as fenestrating subtotal cholecystectomy. Lunevicius recently proposed replacing the term “fenestrating” and “reconstituting” subtotal cholecystectomy for subtotal open-tract and subtotal closed-tract cholecystectomy, considering that the terms “fenestration” and “reconstitution” lack specificity.[14]

Three principal types of subtotal cholecystectomy:

a) Reconstitutive Closed tract Subtotal cholecystectomy (with variably functional miniature gall bladder remnant)

b) Fenestrative or Open tract cholecystectomy (leaving cystic duct open)

c) Non-reconstitutive closed tract Subtotal cholecystectomy (ligating cystic duct)

Current technique of Subtotal Cholecystectomy (Open tract/Closed Tract):

Gallbladder fundus is reached, dissected from adjacent adhered structures as much as safely possible and when further separation is difficult, gall bladder is incised open along its long axis and calculi removed from the lumen up to the gall

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bladder neck and cystic duct if possible. Also, consideration may be given to attempting imaging either via cholangiography through the lumen of the gallbladder or with intraoperative ultrasound. In either the fenestrating or reconstituting type of procedure, the portion of the gallbladder as much as safely possible, is removed while staying above the safety line between Rouviere's sulcus and the umbilical fissure thus avoiding dissection of this area of the hepatocystic triangle. Gall bladder wall part adherent to the liver is usually left in situ and ablated. The latter may be done with electrocautery, argon beam, or saline-linked radiofrequency ablation. This may prevent remnant mucosal secretion and cause inflammatory adhesions leading to earlier closure of the cystic duct. [15] Part of the gall bladder wall adhered densely and closely to adjacent colon or duodenum is left as such. If part of the gall bladder wall gangrenous, it is safely debrided, a bit away from the adjacent adhered vital structures. In the fenestrating procedure, the very bottom of the gallbladder lumen remains open to the peritoneal cavity. There will be a “lip” or “shield” of gallbladder, where the cystic artery branches come onto the gallbladder and these will be transected at that point. Over sewing the cut edge of the gallbladder here may be necessary, although when inflammation is severe, these vessels are sometimes thrombosed. The cystic duct may be sutured from the inside using fine sutures, although this is often not possible. The area should be carefully drained with 1 or 2 closed suction/passive tube drains, depending on the extent of the contamination. In the reconstituting type, the lip is usually somewhat larger and the lumen is closed by various means including sutures and staplers.[16] Here, it is to be noted that the procedures are not distinguished by the amount of gallbladder wall left, but by whether or not a closed remnant gallbladder is created.

Non-reconstitutive closed tract Subtotal cholecystectomy follows the same steps of fenestrating cholecystectomy plus the ligature of cystic duct.

Controversies regarding the different surgical techniques

Subtotal fenestrating cholecystectomy VS Subtotal reconstituting cholecystectomy:

Both subtotal cholecystectomy techniques were recently compared

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In a systematic review and meta-analysis which evidenced that fenestrating types were associated to higher rates of open conversion 10.2% vs. 4.2% ($p < 0.001$), retained stones 6.7% vs. 4.2% ($p = 0.025$), subhepatic or subphrenic collections 5.8% vs. 1.4% ($p < 0.001$), superficial surgical site infections 3.2% vs. 1.5% ($p = 0.030$), postoperative ERCP 14.4% vs. 6.6% ($p < 0.001$) and need for reoperation 3.5% vs. 1.3% ($p < 0.001$) in reconstituting types. [23]

In reconstitutive technique, closing over Hartmann's pouch resulted in a gallbladder remnant, but at the same time, it reduced the incidence of postoperative bile leak/fistula, subhepatic collections & wound infection in the reviews of subtotal cholecystectomy by Henneman and colleagues[17] and Elshaer and associates.[16]

In another systematic review published in 2021 where both techniques were also compared, fenestrating subtotal cholecystectomies were associated to bile leakage rates of 8.52% while reconstituting types had rates of 3.67%, being this the most frequent complication during subtotal cholecystectomies. [24]

In a systematic review and meta-analysis by Nzenwa, et al., reconstituting cholecystectomies had a lower risk of bile leak, intraabdominal collection, intraabdominal infection, wound infection, nonsurgical wound infection, retained gallstones, recurrent biliary events, 30-day readmission, need for ERCP, percutaneous drainage and completion cholecystectomy. [25]

It's important to consider that performing the reconstituting technique is not always possible due to gangrenous gallbladder walls, during which union is not possible thus not allowing proper closure of the gallbladder stump.

On the other hand, Subtotal fenestrating cholecystectomy is not only easy to perform, plus it has the advantage that a remnant gallbladder is much less likely to result than if the lumen of the gallbladder is re-established at Hartmann's pouch, as in the reconstituting technique. Leaving a gall bladder remnant opens

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up the possibility of future concerns related to recurrent or residual disease. However, although bile fistula was more common with the fenestrating technique, these fistulas seem to resolve spontaneously in most cases.[16] Those that do not, may be associated with distal obstruction, as with retained common bile duct stones, which can be dealt with ERCP.

During long-term follow-up (median follow-up time of 6 years), it was shown that episodes of recurrent biliary disease were less frequent with the fenestrating type compared to the reconstituting type (9% vs. 18%).[18]

So, apparently, it seems that the fenestrating type of subtotal cholecystectomy should be preferable, but still knowledge in this area is very incomplete. Studies comparing fenestrating vs reconstitutive subtotal cholecystectomies are scanty and with inconclusive results. Furthermore, the extent to which Hartmann's pouch is resected is probably quite variable, and the effect of leaving different size remnants on the chance of developing subsequent symptoms needs further evaluation. A recent meta-analysis discussed this issue,[16] but articles on the subject rarely provide long-term follow-up of patients, and gallbladder remnants may become symptomatic years after subtotal cholecystectomy, so good data on this topic are lacking.

Laparoscopicvs Open Subtotal Cholecystectomy

Based on the meta-analysis of Elshaer and coworkers,[16] it seems that a subtotal fenestrating cholecystectomy is more likely to be done when an open approach is used. Paradoxically, in their data, bile leaks were more common after a laparoscopic procedure. Possibly, this is due to the improved ability to suture the cystic duct orifice when the procedure is done open, i.e., basically it is then closed tract non-reconstitutive subtotal cholecystectomy.

Open subtotal cholecystectomy has been associated to higher risk of reintervention, surgical site infection and 30-day mortality, with lower risk of bile leakage compared to laparoscopic subtotal cholecystectomy.[25-26] Longer operation time, longer postoperative hospital stay and higher incisional hernia rates have also been reported in open subtotal cholecystectomy. [26]

Bile leakage : Drainand Observe or ERCP

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One of many possible complications of cholecystectomy is bile leakage, and in most studies it was reported to be more frequent during subtotal cholecystectomy.[27] Stent placement for bile leak is a treatment option with high success rates.[28] However, ERCP is associated to additional costs, time and the possibility of complications such as pancreatitis (3.5%), bleeding (1.3%) and/or perforation (0.6%).[29-30]

In most cases after performing subtotal cholecystectomy, especially in the fenestrating types, a drain is placed in the surgical site due to risk of bile leakage (34).

Bile secretion through the placed drain is expected when closing the cystic duct is not possible or when the procedure performed is a fenestrating type subtotal cholecystectomy, nonetheless it should gradually resolve by the 10th to 14th day (13). Due to this it is preferable to wait until bile secretion resolves on its own before considering ERCP with stent placement and/or sphincterotomy. Except for cases in which bile leakage is persistent, the patient lives in a remote location or if there are signs of infections or electrolyte disbalance, keeping the drain during the postoperative period is preferred over early ERCP (13).

Possible unfavourable out comes without causing biliary injury with subtotal cholecystectomy procedurescanbes can be :

- Biliary leak/Fistula
- Subphrenic abscess
- Remnant gall bladder disease (Stump cholecystitis)
- Malignant degeneration in residual gall bladder

Concerns during Subtotal cholecystectomy:

While doing difficultlaparoscopic cholecystectomy, when CVS is not achieved and subtotal

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cholecystectomy is planned as a bailout procedure, these concerns remain in the surgeons' mindset after subtotal cholecystectomy, apart from others inherent to the cholecystectomy procedure:

1. Whether the procedure can be done laparoscopically with best aesthetic result or should be converted to open, expecting better control and pathology related outcome.

2. Procedure should not cause undue damage to the adjacent structures, liver and rest of the extrahepatic biliary tree, so better to remain inside gall bladder whenever such threat appears.

3. Procedure should not cause significant bile leak in the post-operative period, which will need maintenance of subhepatic functioning drain for 2-3 weeks, till leak subsides with no significant USG proven subhepatic collection and normal LFT result. Then the drain will be removed. If bile leak persists, patients need to be evaluated for distal obstruction and dealt with ERCP, which when successfully done, relieves the condition.

   However, to minimize bile leak, undue fiddling to identify and tie cystic duct should be avoided.

4. Mirizzi syndrome, especially type 2 onwards should be excluded.

5. Whenever doing reconstitutive subtotal cholecystectomy, try to leave minimal sac area to prevent remnant gall bladder, so that gall bladder related burden should not be troubling the patient or the surgeon.

6. Whether malignant degeneration can occur in residual gall bladder wall? So, residual gall bladder epithelium should be ablated as much as safely possible, without causing adjacent structure damage.

Considering all these concerns, it seems that laparoscopic open tract or fenestrative subtotal cholecystectomy can meet the most of the demands with minimal sacrifice of some temporary post-operative bile leak, which even most of the time is not there; but still drain need to be maintained for at least 15 days, if ERCP not done pre or post operatively. Present study focuses essentially on the

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feasibility and outcome of this approach only in difficult cholecystitis cases, where CBD & CHD area are grossly left untouched to obviate any biliary injury and also residual gall bladder disease can be avoided, which is possible with reconstitutive subtotal cholecystectomy.

AIMS AND OBJECTIVE:

To Study the outcome of Laparoscopic Subtotal Cholecystectomy without Cystic Duct Ligation (Open tract or fenestrative) for difficult Cholecystitis

Specific Objectives: To evaluate

- the feasibility and ease of performing this procedure in difficult cases
- the post-operative outcome, especially the stigma of bile leak and its impact on post-operative morbidity
- lastly its efficacy in preventing remnant gall bladder disease.

MATERIALAND METHODS:

Study type: Prospective observational study

Study area: Study was conducted in the department of General surgery, IQ CityMedical college and Hospital, Durgapur

Study population: Patients admitted to general surgery department of I.Q City Medical College and Hospital, Durgapur, West Bengal, between January 2015 to December 2022, with finding of difficult anatomy per-operatively.

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Selection criteria

Inclusion criteria

Study subjects were patients of 25 to 60 years of age, posted for laparoscopic cholecystectomy between January 2015 to December 2022, who were found to

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have difficult anatomy, where critical view of safety was not achieved after 30 minutes of laparoscopic procedure.

Exclusion criteria

Patients with following conditions were excluded from the study:

- USG OR CT proved ruptured cholecystitis cases with features of peritonitis (local or generalized)
- Coexisting choledocholithiasis
- Patients not giving consent to the laparoscopic subtotal cholecystectomy
- Patients, who were forced to converted to open due to anaesthesia related issues.
- Patients with subsequent histopathology report suggestive of gall bladder carcinoma were excluded
- Patients with known immunocompromised status, like Diabetes mellitus, severe CLD and CKD, HIV, corticosteroid usage etc.
- Age group less than 25 year and more than 60 years
- Mirizzi syndrome type 2, 3, 4 & 5.

The hospital's Ethics Committee approval was obtained to conduct this study. Informed consents include patient's approval for performing laparoscopic subtotal cholecystectomy with all the above concerns as discussed above.

STATISTICALANALYSIS:

The statistics package used to analyse the data was the Statistical Package for the Social Sciences (SPSS) version 16.0 and the statistics tests used for each analysis is detailed along with the results.

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RESULT:

Between Janurary 2015 to December 2022, 198 cases of difficult anatomy during laparoscopic cholecystectomy were encountered, where critical view of safety was not achieved, after a reasonable attempt of 30 minutes laparoscopic

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dissection, but there were no overt features of malignancy per-operatively and where patient and party had already consented for laparoscopic open tract subtotal cholecystectomy, if need arises. Out of these,

- 13 cases were excluded due to exclusion criteria.
- In the rest 185 cases, there were 131 men and 54 women, of median age 48 (range 25–60) years.
- 171 were dealt with laparoscopic open tract subtotal cholecystectomy without cystic duct ligation. (The indications for subtotal cholecystectomy are shown in Table 1)
- 3 cases were converted to open procedure for anaesthesia related issues,
- 11 cases need to be converted to open for various concerns including non-progress or grossly obscured anatomy. Out of these, 2 were having features of Mirizzi syndrome and 3 were found to have xanthogranulomatous disease of the gall bladder in subsequent histopathology report. So, if we exclude the cases of open conversion due to anaesthesia related issues, out of 182, 171 (93.95%) were able to be managed with LSTC.

In the laparoscopic group (171), median operating time was 90 (range 60–180) min. 7 patients had apparent bile leak during surgery itself, where friability of the cystic duct or infundibular tissue around adjacent CBD warned against any attempt to fiddle and close it. In total, 36 patients had bile leak in the post-operative period, of which 9 were prolonged beyond 14 days including these 7 patients. In the early closure group of 27 patients, amount of bile leak was up to a maximum of 125 ml/day. In the prolonged leak group of 9, the amount of bile leak was maximum up to 275 ml per day. In 4 patients, the leak was managed conservatively and resolved spontaneously between days 15-19. The remaining 5 patients had significantly and persistently raised liver enzymes including ALP & GGT post-operatively. They underwent postoperative ERCP on days 18-21, where small CBD calculi were extracted and stenting was done. Stent placement led to complete resolution of bile leakage in all patients within 96 hours. Out of 36 patients with post-operative bile leak, 27 patients had mild to moderate bile leak, evident on 1st POD onwards, which gradually diminished spontaneously within 14 days. No postoperative bile leaks

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developed in the remaining 135 patients in whom no bile leakage was seen at operation. Among the bile leakage group, 4 patients developed persistent fever beyond 2 weeks, which on USG evaluation was found to be due to subphrenic collection and right sided pleural effusion. It was managed with USG guided aspiration and antibiotics. There were no deaths and no bile duct injuries. On long term follow up, stump calculus and cholecystitis were seen in 5 patients during our study. All of these patients were not having bile leak in the post-operative period.

Table -1

Acute cholecystitis with dense adhesions	61
Chronic cholecystitis with frozen Calot's area	58
Empyema gall bladder with necrotic patches of gall bladder wall	23
Grossly contracted intrahepatic gall bladder	20
Mirizzi syndrome type 1	9

Table – 2

	Number	Percentage
Total patients with difficult anatomy	182	100
Patients managed with Open tract LSTC	171	93.95 %
Patients needed to convert to open	11	6.05 %

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Table 3

	Number	Percentage
Patients manged with Open tract LSTC	171	100 %
Number of bile leak in Open tract LSTC	36	21.05 %
Number of prolonged bile leak beyond 14 days	9	5.26 %
Patient required ERCP for bile leak	5	2.92%
Patients with vascular injury	0	0 %
Patients with biliary injury	0	0 %
Patients with subphrenic abscess and pleural effusion	4	2.33 %
Remnant gall bladder disease (Stump cholecystitis)	9	5.26 %
Follow up malignant degeneration	0	0 %

DISCUSSION:

Safe dissection of the structures in Calot's area can pose a considerable challenge during both laparoscopic and open surgery. During open surgery, a partial cholecystectomy with drainage of the gallbladder stump is used occasionally when the tissues in Calot's area are hostile. As in many other areas of surgical practice, the lessons of open surgery can be relearned and adapted to laparoscopy. This study has shown that LSTC without cystic duct ligation

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represents an alternative to open conversion when dissection of Calot's area is deemed unsafe. Age old textbook teaching in gall bladder surgery is that most important step is to display well the hepatocystic triangle and identify the cystic duct clearly from rest of the biliary channels in the area and its ligature or clipping. However, sometimes, it is not so easy to do so. So, to keep on fiddling the structure in the hepatocystic triangle to identify the cystic duct, can sometimes either be futile or misleading and cause significant vascular or biliary injury. However, the guidance from another key concept of any fistula treatment is that, if distal patency of any tubular structure is intact, all proximal side leaks have tendency to heal on its own. Another idea is that one of the most prevalent cause of difficult hepatocystic triangle anatomy is severe inflammation in the area, which make identification and dissection risky. So, in such circumstances, usually the inflammatory oedema further narrows down or closes the already narrow cystic duct (usual calibre 1-5 mm). Most of the time, this prevents any significant bile leak from the left open cystic duct end. Also, the postsurgical inflammation and fibrosis further assist in permanent closure of cystic duct. Also, the fear of bile leak and resultant chemical peritonitis can be safely tackled with a tube drain in the area. It prevents any significant collection of bile and permits a low level of biliary inflammation only around the leaking cystic duct end, in case the leak occurs. This also promotes fibrosis and closure of the cystic duct end. Persistent bile leak or fistula formation are expected mostly with distal CBD obstruction, as in case of any distally migrated calculus. This can be tackled with ERCP CBD clearance and stenting.

In our study, 36 patients with bile leak, 9 were prolonged beyond 2 weeks, out of which further 4 settled down soon on their own, but rest 5 with deranged LFT not. So, ERCP and CBD stenting was arranged for them, which settled down the bile leak in them. Following this, some of our fellow surgeons were in favour of adopting a policy of early postoperative ERCP and stent insertion, with the aim of shortening the time to resolution of bile leakage and hastening discharge from hospital. An alternative approach in the event of an obvious bile leak would be to attempt closure of the cystic duct orifice within the opened gallbladder, for example by suturing the opening around a probe into the leaking opening.

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Although this may be feasible, it runs the risk of inadvertent impingement on the main biliary tree, and would have to be undertaken with caution. In contrast, it was evident that no or mild postoperative bile leak developed if the gallbladder stump was dry at the end of LSTC.

In our study, out of 171, 9 patients (5.26 %) returned with residual gall bladder disease. However still it is less than 10-13% after total laparoscopic cholecystectomies as reported in some studies[16]. It may be likely that our percentage may further increase with ongoing years of follow-up. One point to be noted here is that all patients returning with residual gall bladder disease were among the non-bile leak group (135 patients with no post-operative bile leak). A likely explanation could be stuck up calculus in residual part of cystic duct, which did not allow bile leak. Other possibility could be failure to identify or reach up to the exact cystic duct region during subtotal cholecystectomy, leaving behind calculus impacted in spherically constricted infundibular area of gall bladder.

It is clear, however, that rates of conversion to open surgery can be reduced significantly by adopting a policy of LSTC for selected patients.

CONCLUSION:

Opened tract or fenestrative laparoscopic subtotal cholecystectomy (LSTC without cystic duct ligation) is a relatively straightforward, easy, safe and effective alternative to open conversion when dissection of Calot's triangle is hazardous.

Limitations and Need for further Study: A multicentre trial and longer follow up for such study are needed to further validate the results of our study in regard to prevention of any biliary injury and remnant gall bladder disease respectively.
Also, better predictors like deranged LFT or amount of bile leak, can be looked for patients, who can be helped with early ERCP to minimize the duration of bile leak post-operatively.

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