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SUBXIPHOID MINIMAL STRESS TRIANGLE MODIFIED MICROCOELIOTOMY CHOLECYSTECTOMY

By
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Aim: *This study addressed a modified microcoeliotomy approach, through the subxiphoid minimal stress triangle, for cholecystectomy in gallstone disease.*
Methods: *From February 2001 to 2004, at Tanta University Hospital, 50 patients with chronic calcular cholecystitis were prospectively randomized into two equal groups:* **Group I***: 25 patients for whom the modified microcoeliotomy cholecystectomy technique had been done.* **Group II***: 25 patients for whom the laparoscopic approach had been done. Their ages ranged from 22 to 65 years (mean ± SD = 40 ± 11.7) with 38 females and 12 males (3.17: 1). The whole* **follow-up period** *ranged from 3-24 months with a mean of 14 months.*
Results: *In group I and II respectively, the operative time was 75 ±10.9 and 45 ±4.6 minutes, intraoperative bleeding occurred in 0% and 4%, hospital stay was 2.13 ±0.3 and 2.17 ±0.37 days, postoperative pain score was 4 ±0.87 and 5 ±1.12, vomiting occurred in 41.7% and 62.5% of patients, off-work time was 6.3 ±1.08 and 6.6 ±1.98 days and no early or late postoperative jaundice..*
Conclusion: *Subxiphoid minimal stress triangle modified microcoeliotomy cholecystectomy technique is a viable, safe, feasible and cheaper alternative to the laparoscopic cholecystectomy.*

Keywords: *microcoeliotomy, cholecystectomy, laparoscopy.*

INTRODUCTION

With the introduction of laparoscopic cholecystectomy, a minimally invasive procedure, cholecystectomy has evolved to an outpatient procedure.[1-3] Patients are able to return to preoperative functional status rapidly with minimal postoperative morbidity and pain.[4] Additionally the procedure has gained acceptance because of the small size of the scar.[5] However, there have been reports of various complications, including damage to the abdominal blood vessels, bowel laceration, and common bile duct injuries, associated with this technique.[6-8] Conversion to open conventional cholecystectomy was required for patients with densely adherent gall bladders, and large stones that require added manipulations.[4]

No body can deny the advantages of the laparoscopic technique which made it as the standard approach for cholecystectomy all over the world. For the third world countries: The technique is still expensive in terms of the price of the laparoscopic set, accessories, maintenance and per-patient cost. Moreover, it is not the set which could be available at all hospitals and it is not the technique which could be mastered by every surgeon, so there is a still need for a new approach which carries the advantages of the laparoscopic approach with its minimal access and conventional open technique with its direct visualization and less cost, meanwhile, avoiding the high cost and complications of the first and the big incision, with its untoward sequelae, of the second. Modified subxiphoid minimal stress triangle micro-coeliotomy cholecystectomy technique may afford these missed privileges and this was the domain of this concurrent study.

The incision for microcoeliotomy is a 3-cm, transverse one & located in the "minimal stress triangle" (MST) in the subxiphoid area [5,9], which is a narrow area, supported on both sides with the costal margins and minimally moves with the respiration hence less pain and minimal incidence of incisional hernia are expected to

accompany incisions at this area together with the fact that these incisions represent direct short access to the Calot's triangle.[9,10]

The microcoeliotomy incision differs from minilaparotomy approach; the major differentiating features of microcoeliotomy technique include: The high subxiphoid location and the shorter length of the incision (3 cm), the use of endoscopic instruments and entry into the abdominal cavity through the falciform ligament to minimize the parietal peritoneum disruption, hence less postoperative pain.[5,9]

The term microcoeliotomy is applied to incisions less than 4 cm, modern minilaparotomy from is 4 to 6 cm and conventional minilaparotomy is from 6-10 cm [10].

This study was conducted to explore the feasibility, effectiveness, complications and safety of a newly modified subxiphoid minimal stress triangle microcoeliotomy cholecystectomy technique and to compare it with the laparoscopic approach as the standard in this issue.

PATIENTS AND METHODS

This study had been carried-out over three years (February 2001-2004) at Tanta University Hospital. The candidates were 50 patients with symptomatizing ultrasonically proved non-complicated chronic calcular cholecystitis. Their ages ranged from 22 to 65 years (mean ± SD = 40 ± 11.7 years) with 38 females and 12 males.[3.17: 1] Consent had been taken from each patient to be included in this study without knowing the type of the operation until discharge. These patients were prospectively randomized into two equal groups using 50 closed envelopes with 1:1 distribution of both operations. The envelope was opened only when the patient was already in the theatre: *group I* (modified microcoeliotomy group): comprised of 25 patients for whom the modified microcoeliotomy cholecystectomy technique had been done. *Group II* (laparoscopic group): comprised of 25 patients for whom the laparoscopic approach had been done.

At the end of the operation in both groups, 4 pieces of abdominal wall dressings were applied as if all patients had undergone laparoscopic cholecystectomy. The type of the operation was kept secret to the patient, all the ward caregivers and the anaesthiologist assessing the postoperative pain and vomiting, who was not involved in anaesthetizing the patients.

Elevation of one or more of the hepatic biological markers (transaminases, alkaline phosphatase and gamma glutamyl transferase), recent history of jaundice and/or ultrasonically proved CBD stones or dilatation (more than 7 mm)[11] was indication for preoperative ERCP. Patients with proved choledocholithiasis were managed first with endoscopic sphincterotomy and stone(s) extraction. When the CBD proved to be free as indicated by clinical, laboratory and U/S evaluation these patients were included in the study.

Patients with: complicated cholecystitis (acute cholecystitis, empyema, mucocoele), cirrhotic liver and portal hypertension and morbid obesity were excluded from this study.

Any concurrent chronic medical problem was properly managed before the operation (5 patients were diabetic and 7 were hypertensive).

The parameters of comparison were arbitrarily classified into:

1. Intraoperative parameters: operative time, intraoperative complications (including: bleeding, inadvertent gall bladder perforation with bile soiling and stones slippage, CBD and/or important surrounding structures injuries), conversion to open conventional cholecystectomy (indication, rate and time taken to convert) and the cost (in Egyptian pounds).

2. In-hospital parameters: Postoperative pain, vomiting, bile leakage (controlled in drained patients, localized or generalized) and hospital stay. *The postoperative pain* had been assessed by **I.** the linear analogue pain scale from 0 to 10, using a 10 cm ruler, with training of each patient, the day before the operation, on how to assess his pain. The results of the linear analogue pain scale were subdivided into four grades [12]: absence of pain: 0; minor pain: 1-3; moderate pain: 4-7 and severe pain: 8-10. **II**. The amount of narcotic and non-steroidal anti-inflammatory drug used to control the pain.

When the patient complained of pain: his pain score was assessed then diclofenac sodium 75 mg im was given. If the pain was not improved within one hour, meperidine 50 mg i.v. was given. A mean of the pain score, narcotic and nonsteroidal anti-inflammatory drug used was calculated at the end of the first postoperative 48 hours.

The discharge criteria were unified in all patients and included: full ambulation, adequacy of oral analgesia, tolerance of adequate oral intake and absence of postoperative complications necessitating further management.

3. Early postdischarge parameters (first 3 months): wound and intraabdominal infections, early postoperative jaundice, off-work time and type of healing and patients' satisfaction with the operation and the scar.

4. Late follow-up parameters (3-24 months): incisional hernia and late postoperative obstructive jaundice.

The whole follow-up period ranged from 3-24 months with a mean of 14 months.

Statistical analysis of the quantitative data was made using t-test, while qualitative data were analyzed using Fisher exact test.

Surgical Technique:

All patients received I.V. 2 gm of a third generation cephalosporin at the time of induction of anaesthesia, then 1 gm I.V. 12-hourly for 2 doses postoperatively.

A. Modified microcoeliotomy technique (Figs. 1-8):

The operation was carried out form the left side of the table after mild elevation of its bridge. The main steps of this technique were done according to Tyagi et al[5] with the following modifications: The minimal stress triangle incision was 3.5 cm opposite the tip of right eighth costal cartilage instead of 3 cm to admit a newly modified Casco retractor (by adding a sliding curved third blade to the Casco retractor; Fig. 4). This retractor was used to retract the abdominal wall and the liver according to the level of gall bladder dissection instead of the three 2.5-cm wide retractors used by Tyagi thus the overload imparted upon the shoulders of the assistants in these narrow tunnel surgery had been obviated, head lamp to facilitate illumination and conventional surgical instruments were found to be more convenient than the laparoscopic ones due to relative extra length and cost of the latter.

In most of the cases, cholecystectomy was done by the fundus-first technique except when the stones were proved by U/S to be small and multiple where the technique conducted as antegrade one. Initial packing with small laparotomy tapes, to isolate the duodenum and colon from the field, was done after lysing any adhesions between the gall bladder and these structures. The modified Casco retractor was positioned in the proper way to open the field and maintain the duodeno-colonic isolation. Distended gall bladder was aspirated first with a 20 cc.syringe or directly with the suction tube if the bile was thick and viscid. If a large stone was found impacted at the Hartmann's pouch, or infundibulocystic area, it was milked up gently using a suitably opened Moynihan's clamp and extracted through a cholecystotomy (opened with diathermy) to facilitate the dissection of the Calot's triangle and gall bladder. Diathermy was used in the dissection and haemostasis all over the technique except in the Calot's triangle (blunt dissection). The cystic duct and artery were secured, only after full and clear anatomical delineation of the area, using a surgiclip applier (not endoclipper) in some cases. Traditional ligatures were found easy to apply using two artery forceps in most cases as a means to contain the cost.

II. Laparoscopic cholecystectomy: was done through the standard four ports approach.

A drain was left in 3 out of the 24 modified microcoeliotomy operations and in 4 out of the 24 laparoscopic ones. The indications for drainage were questionable haemostasis and/or bile soiling during surgery. The drain was removed after 48 hours in all cases.

Postoperatively:

The anaesthiologist (was was not involved in anaesthetizing the patient and kept blinded to the type of the operation) assessed the severity of pain according to the adopted protocol as well as the frequency and amount of vomiting. Close follow-up of all patients by the surgical team to detect any early postoperative complications specially bile leakage, early postoperative jaundice and other systemic complications. Oral fluid intake was allowed 6-hours postoperatively.

All patients were discharged after 48 hours except the 7 drained cases who were discharged after 72 hours, by these times the discharge criteria were applicable. Complete liver function tests and U/S examination had been done before discharge.

The follow up plan entailed evaluation of each patient, by thorough history taking, clinical and ultrasonic examination and liver function tests at one week for three weeks, at one month for three months, at three months for one year then every six months thereafter.

RESULTS

I. Intraoperative results (Table 1):

The operative time was longer in group I than group II (mean = 75 ± 10.9 versus 45 ± 4.6 minutes). The difference was statistically significant ($p<0.05$). No intraoperative complications occurred in group I, while in the group II, there was one case of uncontrollable intraoperative bleeding from the cystic artery which had been injured during dissection of Calot's triangle. This difference was not statistically significant ($p>0.05$). Conversion into open conventional cholecystectomy had been done through a 15 cm long right subcostal incision. It took 5 minutes to convert. In group I: intentional cholecystotomy was done in 6 out of the 24 cases (25%) due to impacted stone at the Hartmann's pouch (4 cases; 16.7%) or the infundibulocystic area (2 cases; 8.34%) but this technique was not feasible in group II. The gall bladder was inadvertently perforated during the dissection leading to stone escape and bile soiling of the field in 3 cases (12.5%) in group I and in 4 cases (16.68%) in group II. This difference was not statistically significant ($p>0.05$). Bile was aspirated, the stones extracted and the field irrigated and drained. The technique was not feasible in one patient (4.17%) in group I (due to unexpected dense adhesions and within 2 minutes

conversion to open conventional cholecystectomy was done by extending the incision laterally for 12 cm) and in one patient in group II (4.17%) due to bleeding. The conversion time was shorter in group I than the group II (2 versus 5 minutes). This difference was statistically significant ($p<0.05$). In both groups, there were no intraoperative injuries of CBD or surrounding structures.

The two patients (one in each group), in whom the entertained technique was not feasible, were excluded from further statistical studies of the results.

II. In-hospital results (*Table 2):*

The postoperative pain was less severe in group I than in group II (mean ± SD linear analogue pain score: 4 ± 0.87 versus 5 ± 1.12), the mean narcotic use (20 mg versus 40 mg). This difference was statistically significant. However, the mean nonsteroidal anti-inflammatory drug use was more in group I than in group II (120 mg versus 107 mg). None of the patients in group I experienced postoperative shoulder pain, while this was a manifest symptom in 15 patients in group II (62.5%). This difference was statistically highly significant ($p<0.001$). Mild infrequent vomiting was less in group I than in group II (40% versus 64.5%). This difference was statistically insignificant ($p>0.05$). No cases of bile leakage or early postoperative jaundice occurred in both groups. The hospital stay was nearly equal in group I and II (mean=2.13 ± 0.33 versus 2.17 ± 0.37days).

III. Early post discharge results - First 3 Months (Table 3):

Wound infection occurred in one case (4.17%) in group I and in two patients (8.34%) in group II. The difference was statistically insignificant ($p>0.05$). In group I it was mild and subsided on 5-days course of first generation cephalosporin without bad sequelae. In group II there were one case with mild epigastric port site infection, which improved on antibiotic within 5 days, and another case with moderate epigastric port site infection, stitches had been removed and wound opened and debrided. A small stone was found and removed from epifascial tissues. Antibiotic course, started (guided by culture and antibiogram). Daily dressing done till infection subsided within 10 days. No cases of intraabdominal infections or postoperative jaundice reported during this period in both groups.

The off-work days were less in group I than in group II (mean = 6.31 ± 0.08 versus 6.6 ± 1.98 days), however, this difference was statistically insignificant ($p>0.05$). All the wounds healed with primary intention in group I while in group II there was one case (4.17%) with secondary intention healing. This difference was statistically insignificant ($p>0.05$).

The patients' satisfaction with the scar was excellent in all 24 cases in group I (100%) and in 23 cases in group II (95.83%). The satisfaction was good in the remaining case (4.17%) of group II, however, this difference was statistically insignificant ($p>0.05$).

IV. Late follow up results (*Table 3):*

None of the patients, in both groups, developed late postoperative jaundice and abdominal U/S revealed no CBD stones or dilatation. Epigastric port site hernia complicated the epigastric wound in one patient (4.17%) in group II, but none in the group I. The difference was statistically insignificant ($p>0.05$).

Table 1. Intraoperative Results.

	Group I **Modified Microcoeliotomy Cholecystectomy** **(n = 25)**	**Group II** **Laparoscopic Cholecystectomy** **(n = 25)**
Operative time (mean ± SD, minutes)	75 ± 10.9	45 ± 4.6
Intraoperative complications:		
Bleeding:	0 (0 %)	1 (4 %)
Inadvertent gall bladder perforation	3 (12 %)	4 (16 %)
Conversion to conventional open cholecystectomy:		
No. of patients	1 (4 %)	1 (4 %)
Indication	Dense adhesions	Bleeding
Time taken for conversion (min.)	2	5
Feasibility	24 (96 %)	24 (96 %)
Cost (Egyptian pound)	2000 L.E.	4000 L.E.

N.B. the converted cases were excluded from further statistical study.

Table 2. In-hospital results.

	Group I Modified Microcoeliotomy Cholecystectomy (n = 24)	Group II Laparoscopic Cholecystectomy (n = 24)
Postoperative pain:		
Mean score (± SD)	4 (±0.87)	5 (±1.12)
Mean narcotic use	20 mg.	40 mg.
Mean nonsteroidal anti-inflammatory drug use	120 mg	107 mg
Shoulder pain	-	15 patients (62.5%)
Vomiting	10 (41.7%)	15(62.5%)
Hospital stay in days (mean ± SD)	2.13 ± 0.33	2.17 ± 0.37

Table 3. Post-discharge Results (follow up phases III &IV)

	Group I Modified Microcoeliotomy Cholecystectomy (n = 24)	Group II Laparoscopic Cholecystectomy (n = 24)
Postoperative infections:		
1. Mild wound infections	1 (4.17 %)	1 (4.17 %)
2.Moderate wound infections	-	1 (4.17 %)
3.Intraabdominal	-	-
Postoperative jaundice	-	-
Off-work time in days (mean+SD)	6.3 ± 1.08	6.6 ± 1.98
Incisional hernia	-	1 (4.17 %)

Fig 1. Incision in the minimal stress triangle opposite tip of 8th costal cartilage.

Fig 2. Peritoneum opened.

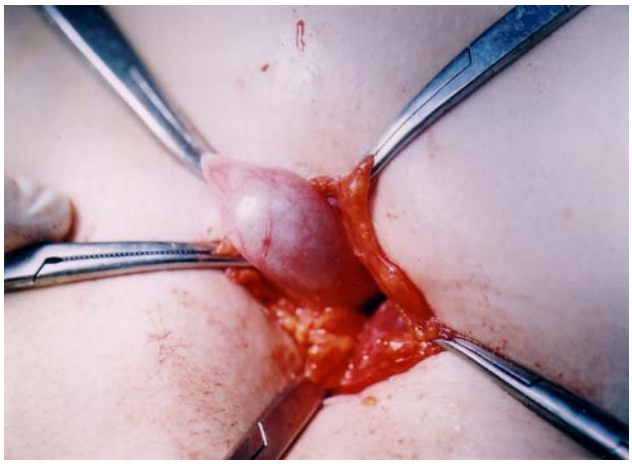

Fig 3. Gall bladder fundus was accessed very easily through the wound

Fig 4. Modified Casco (tribladed).

Fig 5. Gall bladder dissection from the liver bed (retrograde after aspiration).

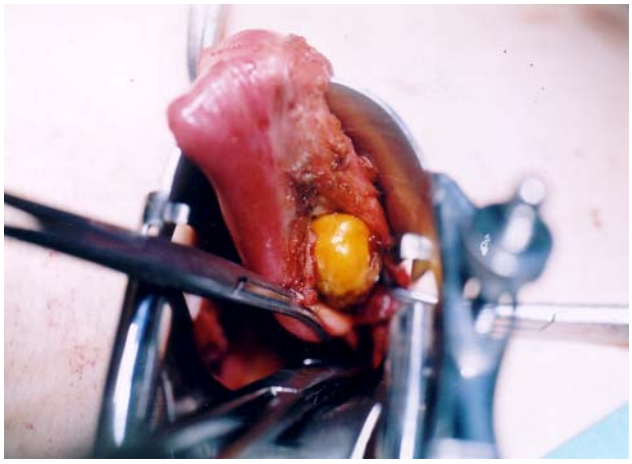

Fig 6. Impacted stone in the Hartman's pouch was milked up and extracted through cholecystotomy to facilitate dissection of Hartmann's pouch.

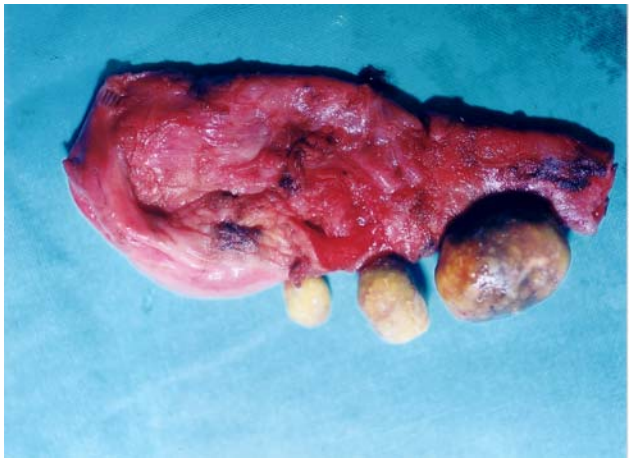

Fig 7. Gall bladder and stones, already out.

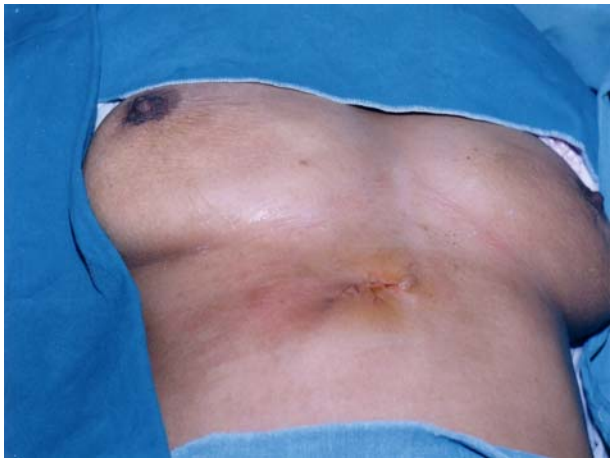

Fig 8. The final Incision was closed with intra Cuticularstitch

DISCUSSION

This study addressed a newly modified minimal stress triangle micro-coeliotomy cholecystectomy technique in a selected group of 25 patients with non-complicated chronic calcular cholecystitis. In this selected category of the gall bladder pathology, modified microcoeliotomy technique was found better than the laparoscopic approach in terms of the conversion time where the same set of instruments are used and the incision is already partially opened and this will guarantee rapid control and solution of any untoward intraoperative problem, postoperative pain specially shoulder pain probably due to locating the incision of microcoeliotomy in the minimal stress triangle and no use of pneumoperitoneum in the microcoeliotomy technique and the cost. The laparoscopic approach was better in terms of operative time. Both techniques were comparable in terms of intraoperative complications, short hospital stay, off-work period and incidence of wound infections and incisional hernia.

Nagakawa (1993)[13] performed cholecystectomy via 2-3 cm right subcostal skin incision (microcoeliotomy) in more than 400 patients, he reported no significant complications and found this approach comparable with the conventional cholecystectomy approach in terms of blood loss and operative time but with greater facility of postoperative recovery and shortening of hospital stay to within 3 days.

Tyagi et al.[5] had used the (MST) microcoeliotomy cholecystectomy technique in the ambulatory setting on non-selective basis in 143 patients and found the technique feasible in 99.3%(higher than the feasibility rate of 96% in this study; most probably due to small number of patients in this study) and finally concluded that the microcoeliotomy approach offers a viable, safe, and cost-effective alternative to the laparoscopic technique for cholecystectomy, especially when facilities for laparoscopy are not available or when the laparoscopic procedure can not be performed Rozsos (1996),[10] after utilizing a vertical microlaparotomy incision in the infrasternal area (MST) to do cholecystectomy, found that this incision resulted in a less postoperative pain and he reported that: micro-laparotomy cholecystectomy offers better results than conventional and laparoscopic cholecystectomy when both surgical and economic factors are considered.

After reviewing 2400 unselected patients who were operated with micro-and minicholecystectomy and comparing them with those cases underwent laparoscopic cholecystectomy, Rozsos, et al. (2003),[14] concluded that micro-and minilaparotomy cholecystectomy with suitable technique and equipments are safe, less expensive choice than the laparoscopic and the standard open cholecystectomy. Comparing microcholecystectomy with laparoscopic cholecystectomy, over a 2-year period, Oyoga15 et al. found that the absolute cost was lower for the microcholecystectomy group than for the laparoscopic group while the operative time and post operative pain were comparable in both groups but the postoperative complications were more in the laparoscopic group (a finding that is consistent with the results in this study) where they reported one case of myocardial infarction and one case of cystic duct stump leak in this group. They concluded that microcholecystectomy can be used as a viable alternative to laparoscopic cholecystectomy especially in patients who cannot tolerate laparoscopic procedures and in areas where cost containment is critical.

Sharma, et al[16] retrospectively reviewed the outcome of cholecystectomy performed through a 3-5 cm transverse subcostal incision and they reported the following results: mean operative time of 61.6 minutes (range 35-130), conversion rate of 3.6%, mean number of analgesic doses required of 3.4 (range 3-8), hospital stay of 1.4 days(range 1-15) and off-work time of 13.3 days (range 8-61). When they compared these results with those of a published series of laparoscopic cholecystectomy, they concluded that the minilaparotomy technique is considered safe, viable alternative to laparoscopic cholecystectomy in the third world and they added that the laparoscopic technique requires expensive equipment and special training.

In laparoscopic cholecystectomy, Nardello, et al[17] reported 3.9% conversion rate (comparable to 4.17% in this study), Aytac and Cakar(18) reported 10.6% and Hui, et al[19] reported 36% gall bladder perforation (16.8% in this study), Lepner, etal[20] reported 30% shoulder pain (half the incidence of 62.5% in this study), Shindholimath, et al[21] reported 6.3% wound infection rate (comparable to 8.34% in this study), Ong and Watkins[22] reported a case of cutaneous sinus at the umbilical port following spillage of gall stones, a finding similar to that found in this study on debriding moderately infected epigastric port site in one patient where a small stone had been extracted and Mittermair, et al[23] reported a case of necrotising fasciitis with clostridium perfringens after laparoscopic cholecystectomy.

In conclusion, subxiphoid minimal stress triangle modified microcoeliotomy cholecystectomy technique is a viable, safe, feasible and cheaper alternative to the laparoscopic cholecystectomy, at least in noncomplicated chronic calcular cholecystitis, specially in the poor third world but needs patience, precision and skill to avoid complications of the narrow tunnel surgical approaches.

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