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IS MODIFIED OPEN MICRO-CHOLECYSTECTOMY STILL VALID IN THE ERA OF LAPAROSCOPIC SURGERY?

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Background:-*Laparoscopic cholecystectomy (LC) has become the standard procedure for treatment of symptomatic gall bladder lithiasis. It has the advantages in the term of better cosmetic results, reduced postoperative pain and early return to full activity. This study was conducted to evaluate the validity of modified microcholecystectomy without muscle cutting as an alternative procedure.*

Patients and Methods:-*This prospective controlled study included 90 patients with symptomatic gall bladder stones. Patients were randonized to conventional cholecystectomy (CC, n=30), modified micro-cholecystectomy without muscle cutting (MC, n=30), and laparoscopic cholecystectomy (LC, n=30). Modified microcholecystectomy (MC) was carried out without muscle cutting and using fibrooptic cable illumination and clipping of the cystic artery and duct. The operative and postoperative data in all procedures were evaluated.*

Results:-*There was no significant difference between MC and LC procedures in the term of operating time, magnitude of operative trauma (IL-6 levels), postoperative pain, and early ambulation. In the meantime, these parameters were significantly higher in CC (P<0.05).*

Conclusion and recommendations:-*Modified open microcholecystectomy by the technique used in this study could be claimed to be a reasonable alternative to LC in non obese patients particularly if the laparoscopic surgery facilities are not available or there are restrictions to its use.*

Key words: cholecystectomy, laparoscopic ,microcholecystectomy, conventional, interleukin-6

INTRODUCTION

The open conventional cholecystectomy through an 8 to 12 cms length muscle cutting incision was until recently considered the golden standard of treatment of symptomatic calcular cholecystitis [1,2]. A relatively recent report of open conventional cholecystectomy in almost 43,000 patients reminds us that it is an extremely safe and effective operation [3].

The use of a smaller incision in open mini-cholecystectomy of 5-7cm length with a limited muscle cutting, proved to have the advantage of substantially reduced hospital study because of less pain [4,5].

Several studies were designed to establish whether less trauma to the abdominal wall by further decreasing the size of laparatomy and the extent of muscle cutting lead to minimize the postoperative pain with the objective of more rapid recovery and return to work [6,7,8].

The use of trocar incision in laparoscopic cholecystectomy generally leads to significant decrease of both the postoperative pain and the inpatient hospital stay [9,10,11]. Most of investigators are enthusiastic about laparoscopic cholecystectomy and considered it as the gold standard operation of symptomatic gall bladder stones [6,10,11] despite the higher risk of common bile duct (CBC) injury which has been recorded up to 10 fold compared with that after open conventional cholecystectomy [12,13,14].

In this study, a modified micro-cholecystectomy was done through 4cm incision without muscle cutting and using a fibro-optic cable illumination and clipping of the cystic duct and artery. The main objective of this study was to find out if there is still a place for open micro-cholecystectomy in the era of laparoscopic surgery.

PATIENTS AND METHODS

This randomized prospective controlled study included 90 patients with symptomatic calcular cholecystitis underwent elective cholecystectomy. Obese patients with more than 30% overweight were not included in this study. Also, patients with acute cholecystitis, CBD stones, associated abdominal pathology and history of DVT (thromboembolic disease) were excluded. All patients included in this study asked for a safe operation, and they did not care about the approach they would be subjected to. The patients were divided randomly into three groups each of 30 patients. Randomization was carried out using 90 presealed envelops immediately before operation. The patients who underwent open conventional cholecystectomy, modified microcholecystectomy, and laparoscopic cholecystectomy were included in group I (GI, n=30), group II (GII, n=30) and group III (GIII, n=30) respectively. Routine preoperative evaluation of all patients included clinical examination, ECG, chest X ray, abdominal ultrasongraphy and conventional laboratory investigations. Endoscopic retrograde cholangio-pancreatography (ERCP), sphincterotomy and stone extraction were done in cases with CBD stones within 24 hours before cholecystectomy. Patients in whom ERCP failed to clear the CBD were excluded from the study. A peripheral venous blood sample was taken from each patients 2 hours before operation for detection of the serum interleukin-6 (IL-6).

**** Cholecystectomy operations:***

** Conventional Cholecystectomy: (CC):*

The operation [15] was done through a 8-13cm right subcostal muscle cutting incision. The cystic duct and artery were cut between ligatures. Then the gall bladder was meticulously dissected from its bed in the liver. A subhepatic tube drain was inserted through a separate stab in the anterior axillary line. The wound was closed in layers.

**Modified Microcholecystectomy (MC):*

A transverse epigastric incision of 4cm length was done at the level of the 9th rib and its center crossed the midline. The right and left rectus sheaths were exposed without over undermining of the subcutaneous tissues. Both anterior rectus sheaths were incised in the direction of skin incision to expose the right and left rectus muscles. Each muscle was retracted laterally to expose their posterior sheaths which were incised transversely with their underlying peritoneum. No muscle cutting was needed in this procedure. The falciform ligament was incised using diathermy or between 2 transfixing ligatures. Using narrow Deever retactors, the Calot's triangle was directly exposed. A cable light source was used to illuminate the narrow operative field. The cystic artery was dissected and cut between 2 proximal clips and a distal one. The cystic duct was similarly dealt with and the gall bladder was dissected meticulously from its bed in the liver (Fig 1-4).

In difficult cases, the incision might be extended up to 7cm (minicholecystectomy). If the incision exceeded 8cm with muscle cutting, the case was considered a conversion to conventional cholecystectomy (CC) [16]. A subhepatic tube drain was inserted through a separate stab at the anterior axillary line.

**Laparoscopic Cholecystectomy (LC):-*

Induction of pneumopertoneum was achieved using CO2 gas insuflation. The procedure [17] was done through 4 ports: an umbilical (10mm), epigastric (10mm), subcostal and anterior axillary (5mm) ones. After gall bladder extraction, a subhepatic drain was inserted through the anterior axillary trocar incision. The fascial layer of the 10mm incisions were closed with figure of eight 1/0 vicryl stitch, then the skin of all incisions were closed with subcuticular 4/0 vicryl stitches.

N.B: In all procedures the following items were considered:

- The subhepatic tube drain was essentially used for early detection and accurate monitoring of postoperative bleeding or bile leakage. It also helped the randomization of the type of operative procedure during the postoperative follow up.
- Wounds were injected with 0.5% bupivocaine (up to 20 ml) at the end of each procedure.
- The operating time for each procedure was recorded as the time taken between the beginning of skin incision (the beginning of gas insufflation in LC) and the end of the skin closure.
- The wound dressing was made to be the same in all cases whatever the procedure used, so that neither the patient or the nurse could differentiate the type of operation postoperatively in the ward. In CC & MC, the subcostal dressing extended from the midline to a point lateral to the midclavicular line with a

fake dressing at the umbilicus. In LC, a single subcostal dressing extended as in the other 2 groups to cover the epigastric and the midclavicular trocar incision and a second dressing covered the umbilical trocar site. In all patients of the 3 groups, the subhepatic drain was inserted through the anterior axillary incision.

- All cases were planned to be inpatient for up to 10 days postoperatively under close observation. The time at which the patient was fully ambulated and fit for discharge was recorded in each case. At that time, the patient was transferred to another ward to relatively feel at home. This helped the objectives of close follow up and randomization as well.

Postoperative follow up:

All patients were reviewed three times daily for the first two days and twice daily for the subsequent days. Every time, the vital signs, abdominal examination and drain output were recorded. Pain sensation levels were reported subjectively by the patients every 2 hours during the day time using a visual analogue scale (VAS). According to this scale, slight pain was defined as 0-3, moderate pain as 4-6 and severe pain as 7-10[18]. Peripheral venous blood samples were taken from patients attended the follow up period on the days ½, 1, 2, 3, 4, 5, 7 and 10 postoperatively for IL-6 level estimation. Any complication was managed and recorded.

Estimation of IL-6:-

The IL-6 was measured with a commercial competitive enzyme immunoassay (ETA) kit (Accucyte Human IL-6) provided by (Cytimmune Science Inc.) USA.

RESULTS

This study included 90 cases of chronic calcular cholecystitis which fulfilled the specified criteria out of 110 admitted cases. The remaining 20 cases were excluded from this study due to overweight (n=15), previous upper abdominal operation (n=2), CBD stones failed to be extracted endoscopically (n=2) and history of DVT (n=1).

The male to female ratio, the mean age and body weight were almost similar in the 3 groups of this study (Table, 1).

There was no operative mortality in any of patients included in this study. Nine patients did not complete the 10 days inpatient follow up (4 in MC & 5 in LC). Those 9 patients had no post operative complications and asked to leave the hospital on the 4th day postoperativly. They also lost to complete the IL-6 follow up (Table 5).

The mean operating time of MC (converted procedures to CC were excluded) was significantly shorter than that in CC ($P<0.05$). In LC (converted cases were excluded), the mean operating time was less than that in CC, although the difference was not statistically significant. The mean operating time of LC was 12 minutes longer than that of MC. The mean operating time of LC converted to CC was significantly longer than that of converted MC cases ($P<0.05$) (Table, 2).

Conversion to open conventional (CC) surgery occurred in 4 out of 30 cases (13.334%) of LC. It was due to marked adhesions in 2 cases, instrumental failure in one case, and in the last one the induction of pneumoperitoneium caused severe haemodynamic instability (Table, 2).

In MC group, 23 out of 30 (76.7%) patients underwent microcholecystectomy through an (4 cms) incision. Due to mild adhesions in other 5 (16.7%) cases, the skin incision was extended to the right to be 5-7cm as mincholecystectomy. In the remaining 2 (6.7%) cases, the operation was difficult due to marked adhesions which needed conversion to CC by cutting the right rectus muscle and the anterior abdominal wall muscles with extension of the skin incision to be about 8-13 cm in length (Table, 2).

Pain which needed analgesic injection was more severe in cases of CC particularly in the presence of wound complication than in the other 2 groups. In the meantime, pain and analgesic requirement were almost similar in both MC & LC which were not converted to CC. Pain was more severe in cases converted to CC particularly in those started as LC (Table, 3). It was noticed that pain in CC & MC groups was located around the surgical incision while in LC the shoulder pain was predominant.

Analgesic (Piroxicam 20 mg/ml IM [Feldene-phizer]) was injected intramuscularly as a routine on the first postoperative day. On the second and third days, the patients received the same injection for severe pain and oral tablete (roficoxib 12.5 mg [Vioxx-MSD]) for moderate and mild pain. On the fourth postoperative day, only 3 cases in CC group needed oral analgesic for painful wound infections. Patients in LC group were asked to adopt a semisetting position in bed to decrease diaphragmatic irritation and its subsequent shoulder pain (Table, 3).

Early wound complications in CC cases were significantly higher than those in MC or LC groups ($P<0.05$). It occurred in 10 out of 30 (33.33%) in patients underwent CC. Of these 10 patients, 5 had a considerable seroma needed repeated aspiration, 4 suffered from a frank wound infection required drianage and in the last one, there was a wound dehiscence to which immediate repair was carried out. In the CC group, a single case developed

incisional hernia 6 months postoperatively. Wound complications in MC and LC groups were almost similar. There was a single case of bile leakage in LC group due to slippage of the cystic duct clips which treated by endoscopic CBD stenting (Table, 4).

Serum IL-6 was almost the same in MC & LC cases which were not converted to open CC. In CC, the serum IL-6 peak was significantly higher than in the other 2 groups ($P<0.05$). It was noticed that cases of MC & CC which were converted to CC surgery showed higher levels than the primary open CC and those converted after LC had higher levels than after MC (Table 5 & Fig. 5). In all groups, wound infection caused higher and more persistent increase in serum IL-6 which did not decrease except after infection resolution (Table 5, Fig 1). In this study, the peak of IL-6 levels in cases with wound infection was significantly higher in CC than in the other 2 groups ($P<0.01$).

The postoperative ambulation and fittineses of the patients to be discharged were about 2 days earlier in both MC & LC than in CC. The return to normal activities and work were almost the same in MC & CC not converted to CC (Table, 6).

Table (1): ***The preoperative data of patients in this study.***

	(CC, n=30)	***(MC, n=30)***	***(LC, n=30)***
Age (years)	52.1±13.2	50±14.6	53.3±12.8
Sex ratio (M:F)	6:24	7:23	5:25
Boraux index	1.14±0.16	1.08±0.19	1.13±0.18
ERCP stone. (case)	2	3	2

Table (2): ***Operative data in patients in this studies.***

	(CC, n=30)	***(MC, n=30)***	***(LC, n=30)***
Operating time (min) (Conversion were excluded)	92.8±18.8	64.2±12.8	76.2±14.2
Conversion to CC	-	2 (6.667%)	4 (13.334%)
Operating time for converted cases (min)	-	105±29.8	155±22.4

Table (3): ***Subjective pain sensation after cholecystectomy.***

Operation	*1st day*			*2nd day*			*3rd day*		
	Mild	*Moderate*	*Severe*	*Mild*	*Moderate*	*Severe*	*Mild*	*Moderate*	*Severe*
CC (n=30)	11	10	9	13	12	5	18	8	4
• *Sound wound (20)*	*8*	*6*	*6*	*11*	*8*	*1*	*17*	2	1
• *Complicated wound (10)*	*3*	*4*	*3*	*2*	*4*	*4*	*1*	6	3
MC (n=30)	10	13	7	15	11	4	20	8	2
• *Micro (23)*	9	10	4	13	8	2	18	4	1
• *Mini (5)*	1	3	1	2	2	1	2	3	-
• *Conversion (2)*	-	-	2	-	1	1	-	1	1
LC (n=30)	14	11	5	17	10	3	21	7	2
• *LC (26)*	13	10	3	16	8	2	19	6	1
• *Conversion (4)*	1	1	2	1	2	1	2	1	1

Table (4): ***Postoperative complications.***

Complications	***(CC, n=30)***	***(MC, n=30)***	***(LC, n=30)***
Early wound complications:	10	3	2
• *Seroma*	*5*	*2*	*1*
• *Infection*	*4*	*1*	*1*
• *Burst*	*1*	--	--
Late wound complications:			
• *Burst*	*1*	--	--
DVT	--	--	--
CBD injury	--	--	--
Bile leakage	--	--	1

Table (6): ***Time of discharge and return to full activities and work in days.***

	CC (n=30)	***MC (n=30)***	***L.C (n=30)***
*Time of fitness to discharge	5.8±2.8	2.5±1.4	1.95±0.8
* Return to full activities	8.8±2.8	5.2±2.1	4.8±1.8
* Return to work.	38.4±10.2	22.2±5.8	19.4±4.4

Table (5): *Pre and postoperative serum IL-6 levels in patients who completed the follow up.*

Operations	Serum IL-6 levels pg/ml								
	Pre operative	Post operative (days)							
		½	1st	2nd	3rd	4th	5th	7th	10th
CC operations (30)									
-Sound wound (20)	9.02±1.6	48.25±4.90	68.24±6.2	26.24±2.9	13.8±2.20	14.42±2.6	11.58±2.2	10.88±2.10	9.22±2.10
-Wound infection (10)	9.02±1.6	70.38±28.12	20242±29.2	240.82±30.8	260.24±32.82	280.88±40.2	102±28±11.82	40.22±5.2	20.82±4.2
MC operations (26)									
-Micro(21) sound wound (18)	8.86±+1.4	36.24±5.2	44.04±5.4	18.92±3.2	14.22±3.1	11.28±3.4	11.88±1.9	10.38±2.2	9.04±2.2
-Micro(21) wound infection (3)	8.86±+1.4	55.33±8.3	102.33±15.2	118.0±16.0	120±16.0	124±17.3	62±6.9	22±3.9	16±3.1
-Mini (3)	8.86±+1.4	38.0±7.0	50.0±8.0	20.5±6.5	13.5±3.5	12.0±3.0	10.5±2.5	11.0±2.5	10.5±2.0
-Conversion to CC (2)	8.86±+1.4	55.0±9.5	78.5±14.5	30.0±8.5	18.0±5.5	15.5±5.5	13.0±4.0	11.5±3.5	9.5±3.5
LC operations (25)									
-LC(21) sound wound (19)	8.78±1.8	32.88±4.22	42.28±5.4	16.22±3.1	12.82±2.9	10.08±2.2	10.24±2.1	9.92±2.2	8.98±1.9
-LC(21) wound infection (2)	8.78±1.8	50.5±5.5	98.0±18.0	102.5±20.5	108.0±22.0	110±23.0	54±8.0	20 ±5.0	14±4.0
-Conversion to CC (4)	8.78±1.8	60.0±6.9	82.25±8.2	35.0±4.1	16.25±3.9	16.25±3.4	12.0±2.8	12.0±1.8	9.25±2.0

Fig. (1): The skin incision

Fig. (2): Exposure of the anterior rectus sheath

Fig. (3): Gall bladder extraction

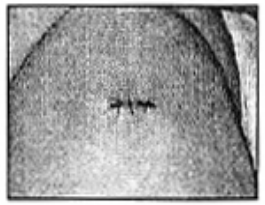

Fig (4): Skin stitches just before removal

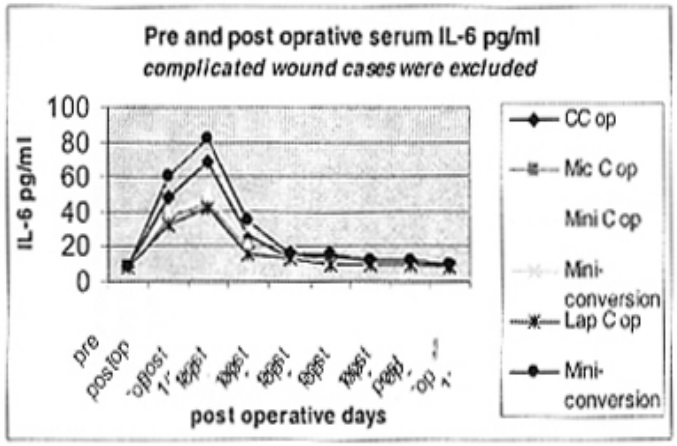

Fig (5)

DISCUSSION

Dubois et al. described the minicholecystectomy in 1981 and perfected this technique during 1980s before developing the laparoscopic approach [19]. Subsequent studies revealed favorable reports concerning a better patient's tolerance to smaller muscle cutting incision with lesser surgical trauma [4,5,16].

At present, laparoscopic cholecystectomy (LC) has become the standard procedure for treatment of symptomatic gall bladder in developed counteries[15]. Several studies have proved the advantages of LC in the term of better cosmetic results, reduced analgesic intake and potentially more rapid discharge from hospital [9,10,11].

No doubt about LC advantages has been raised, although several studies have reported more iatrogenic CBD injuries up to 10 fold compared with that after CC[12,13,14]. Also, CO2 pneumoperitoneum may be risky in elderly patients with cardiopulmonary and liver diseases[20,21]. Nevertheless, the present study was carried out not to prove the superiority of MC over LC, but to find out its validity as an alternative procedure in non-obese patients when LC is not available or contraindicated.

There is no universal cut off figures of the incision length differentiating the various types of open cholecystectomy. However, most authors have agreed that the incision should not exceed 4cm length in microcholecystectomy, 5-7cm in minicholecystectomy and 8-13cm or more in conventional cholecystectomy[16].

In the approach used in this study, cholecystectomy could be done without doing muscle cutting through a single small transverse epigastric incision (micro- and mini-cholecystectomy) in 28 out of 30 (93.33%) cases. Previous studies reported near similar rate using small muscle cutting laparotomy incision [20, 22, 23].

Several previous studies have proved a well correlation between the increase in serum IL-6 and the intensity of surgical trauma [24,25,26] and infection [26,27,28]. In this study, estimation of serum IL-6 was used to evaluate the magnitude of operative trauma in the 3 cholecystectomy procedures. The IL-6 levels were significantly higher in CC than in the other 2 groups ($P<0.05$) particulary if complicated with wound infection ($P<0.01$).

In the present work there was no significant difference between MC and LC procedures in the term of operating time, postoperative pain, serum IL-6 levels, the time at which the patient was fit for discharge and the time needed to return to normal activities and work. Also, these parameters were more favorable in both MC & LC compared to CC.

The conversion rate of MC to CC (6.67%) was lower than that of LC (13.33%). Also, in case of conversion, the operating time was significantly longer in LC than in MC ($P<0.05$). Moreover, the magnitude of surgical trauma (indicated by higher serum IL-6 levels) was more in LC converted to CC. The later might be explained by the longer operating time in addition to the pneumoperitonum effect.

Evaluation of the MC in previous studies revealed controversial results. Some investigators concluded that MC could not be regarded as a true alternative to the superior LC technique [29,30]. Other reported more favorable results of MC than LC [31]. In the meantime, some investigators found no clear cut advantage for either operation [20].

The favorable outcome of modified MC operation in this study might be suggested to be attributed to:

- The small skin incision (4cm) with minimal subcutaneous dissection minimized the postoperative pain, wound seroma and infection.
- Avoidance of muscle cutting decreased the postoperative pain.
- The trap door effect of the rectus muscle and sheath secured the incision against wound dehiscence and incisional hernia.
- The use of fibro-optic cable light source offered an excellent illumination. Nevertheless, as this needs an extra hand during surgery, it may be worthy to be replaced by a headlight.
- The use of clips to control the cystic artery and duct is easier and faster than the traditional ligation particularly in case of working through a small incision.
- The incision is located at the base of infrasternal triangle between right and left angles of the 9th ribs which is less involved in respirotory muscle movement [31]. This may have the advantage of decreasing the postoperative pain, wound dehesines and less likely to affect the respiratory movement. Moreover, this approach exposes directly the Calot's triangle which allows a safe and rapid dissection.

Despite the favorable results of MC in this prospective controlled study, we should admit that the sample size was

quite small compared with that in other previous retrospective studies [16,22]. Also, patients in this study were selected to be non obese with no previous upper abdominal operation although randomly distributed among the 3 groups of cholecystectomy. Furthermore, the exploratory facility is more in favor of LC than MC although the latter has the advantage of tactile sensation. Also, for the training of junior surgeons, LC has an advantage because the trainee can see what is happening whereas the opposite is the case with MC. In the meantime, MC needs reasonable skills to be done safely and rapidly through a small incision. Lastly, we should expect some resistance against the widespread use of MC from the companies that produce laparoscopic equipments and the doctors and patients who have become so enithusiastec about laparoscopic cholecystectomy.

CONCLUSION

The results of this study revealed that modified microcholecystectomy (MC) without muscle cutting and using fibrooptic cable illumination and clips is a safe, rapid and economic procedure. It is comparable to laparoscopic cholecystectomy (LC) in the term of magnitude of operative trauma, improvement of postoperative pain, the time at which the patient was fit for discharge from the hospital and the time needed for full activities and return to work.

RECOMMENDATIONS

Modified open microcholecystectomy by the technique used in this study could be claimed to be a reasonable alternative to LC in non obese patients particularly if the laparoscopic surgery facilities are not available or there are restrictions to its use.

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