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Laparoscopic Ultrasound–Guided versus Percutaneous Radiofrequency Ablation in Treatment of Unresectable Hepatocellular Carcinoma

Sherif Z Kotb, Tamer F Yousef, Yaser M Foda

Department of Surgical Oncology, Faculty of Medicine, Mansoura University, Mansoura, Egypt

Abstract

Objective: The purpose of this study was to compare laparoscopic ultrasound–guided radiofrequency ablation (LUSRFA) versus percutaneous radiofrequency ablation (PRFA) in treatment of localized hepatocellular carcinoma (HCC).

Methods: From January 2005 through April 2008, for 60 consecutive patients, who were diagnosed with localized primary liver cancer and underwent percutaneous RFA (n = 30) or laparoscopic ultrasound guided radiofrequency ablation (n = 30) at our institution. RFA was evaluated prospectively intra- and postoperatively (1, 6, 12, 18 and 24 months after surgery).

Results: Intra and postoperative complications were significantly lower in the LUSRFA group than in the PRFA group. The Hospital stay, intraoperative complications, early and late postoperative complications were significantly reduced with LUSRFA. However, there was insignificant decrease in tumour volume in both groups. Furthermore, Local recurrence and distant metastases in the LUSRFA group showed a significant decrease during follow-up periods.

Conclusion: LUSRFA could be a valuable alternative treatment for selected patients with localized unresectable hepatic malignancies.

Keywords: Radiofrequency; primary liver tumor; local ablation of liver malignancy; laparoscopic radiofrequency.

INTRODUCTION

Hepatocellular carcinoma (HCC) is one of the most common solid tumours in the world with, at least, one million new cases per year.[1] The majority of patients with hepatic cancer have irresectable disease at the time of presentation.[2]

Locoregional therapy has become the focus of interest in recent years, hence if the disease is confined completely or largely to the liver, local tumour ablative therapies can be performed, with good local control of the disease.[3] Local ablative therapies include: ethanol injection; acetic acid injection; cryotherapy ablation; microwave coagulation; laser therapy; and radiofrequency thermal ablation.[4,5]

Radiofrequency ablation (RFA) has both a curative and palliative role in treatment of solid tumours.[6] It is a safe and effective treatment modality to achieve tumour destruction in patients with unresctable hepatic malignancies.[7,8] Although the RFA can be performed via either laparotomy or percutaneously, there is some data focusing on laparoscopic approach.[9]

The main aim of thermal tumour ablation therapy is to destroy the entire tumour by using heat to kill malignant cells without damaging adjacent vital structures, with 0.5-1 cm safety margin of apparently healthy tissue adjacent to the lesion.[10]

The aim of the study was to evaluate laparoscopic ultrasound guided RFA comparing with percutaneous RFA in treatment of localized HCC in patients not candidate for hepatic resection.

PATIENTS AND METHODS

From January 2005 to April 2008, the medical records of 63 patients with localized HCC requiring RFA at Oncology Center Mansoura University (OCMU), in Egypt, were reviewed. All patients were self-referred and consisted of PRFA group (n = 30) and LUSRFA group (n = 33). Patient selection for LURIA was made preoperatively on the basis of history, physical, and radiological diagnostic evidence of localized HCC, three patients were referred to other facilities, as they were not candidate for RFA as it invade important pedicle as detected by IOUS and thus excluded from the study. Thus, each group was of 30 patients.

Inclusion Criteria

All the cases of HCC included in the study were considered unresectable due to bilobar location of tumours (n = 2), or reduced functional hepatic reserve (n = 58), in a site suitable for the laparoscopic approach (n = 33), with patent portal vein, and away from a large main blood vessel or main biliary duct. With no evidence of extrahepatic disease, vascular or biliary invasion,

or marked bleeding tendency with prothrombin time more than 50% and a platelet count more than 100000/mm^3. With absence or minimal ascites.

Surgical Technique

Ablation was done by the RF 3000 generator (Radiotherapeutics) with a power of up to 200 W and 7 electrode prongs. Maximum power output of the RF generator, amount of electrode array deployment from the trocar, and duration of the effective time of the ablation were established at the beginning of the procedure with the goal of destroying the visible tumour mass plus a 0.5 to 1 cm safety margin all around.

Laparoscopic Assessment

After peritoneal insufflations, laparoscope was inserted through a 10-mm trocar to assess stage of the tumour and any abdominal spread. Exposure and isolation of the liver from surrounding tissue was done (Fig. 1).

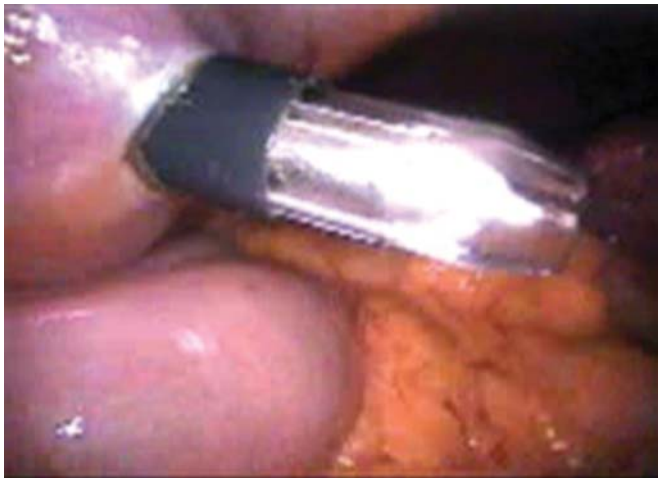

Fig. 1: A Laparoscope exploration

Laparoscopic Intraoperative Ultrasound (IOUS) Assessment

An ultrasound probe was inserted through the second trocar to assess any radiographically occult or unablatable disease, detect any extrahepatic lesion (if present was biopsed), better declaration of the number and location of liver tumours, and decide the puncture point (Fig. 2).

Ultrasound-guided Laparoscopic RF Ablation

The RF electrode was accurately placed into the tumour, without puncturing the nearby blood vessel (under the ultrasonic guidance). We indirectly puncture of the tumour by the RF electrode through non-tumourous liver parenchyma, to avoid needle track seedling, (Fig. 3). The tip of the needle (with retracted electrodes) was advanced under ultrasound guidance to the proximal edge of the lesion, and the electrodes were deployed to 2 cm (Fig. 4). The generator was turned on and runs by an automated program. The temperatures at the tips of the electrodes were controlled and the peak power is maintained until the temperature reaches the preselected target temperature (between 90° and 100°C). After the target temperature was achieved, the curved electrodes were advanced step-by-step to full deployment. When the electrodes were fully deployed, the program maintains the target temperature by regulating the wattage (Fig. 5). Then the ablation was performed with ablation margin of 0.5-1 cm to minimize the chance of local recurrence. We irrigate bile duct by ice-cold saline to avoid bile duct injury. After retracting the hooks, track ablation was performed at temperature above 75°C with the aim of preventing any tumour cell dissemination, as well as stop bleeding (Fig. 6).

For larger tumours, multiple ablations were done to be overlapped to build a composite thermal lesion with sufficient size to kill the entire tumour and to provide 0.5-1 cm tumor-free margin, we applied RF prior to any needle or array repositioning,

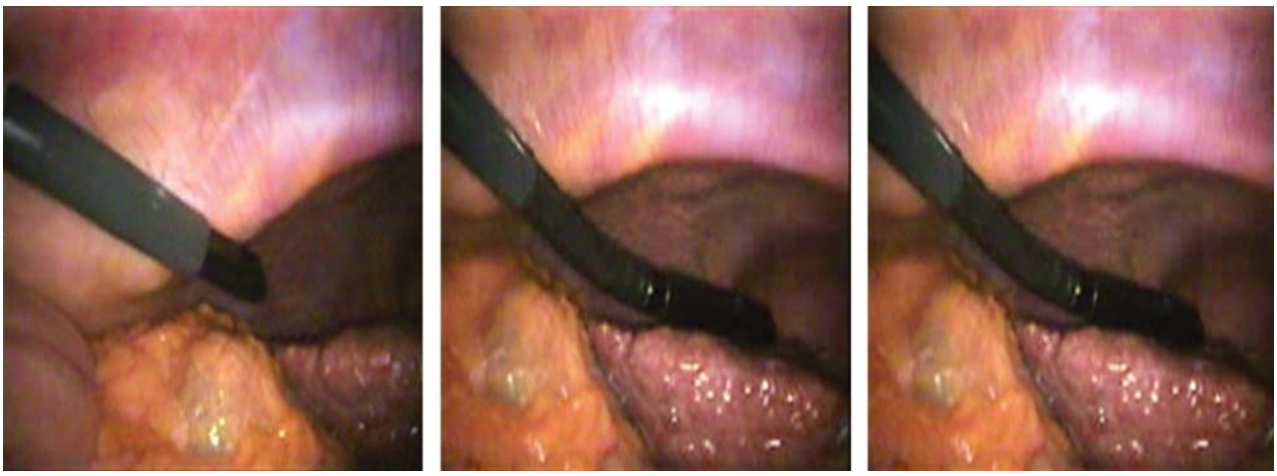

Fig. 2: Laparoscopic ultrasound assessment for radiographically occult or unablatable disease

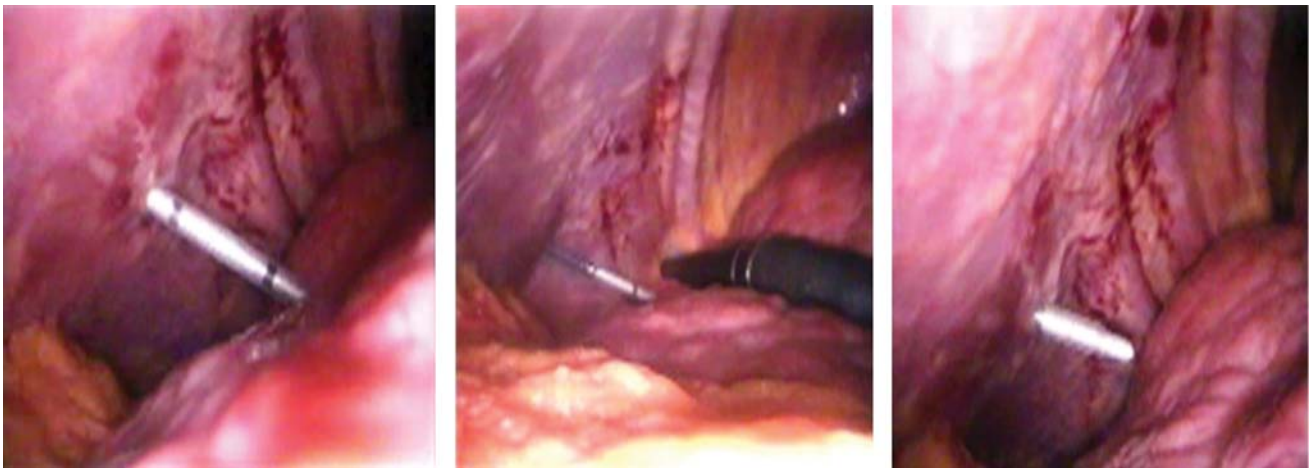

Fig. 3: RF electrode was accurately placed into the tumor, without puncturing the nearby blood vessel (under the ultrasonic guidance)

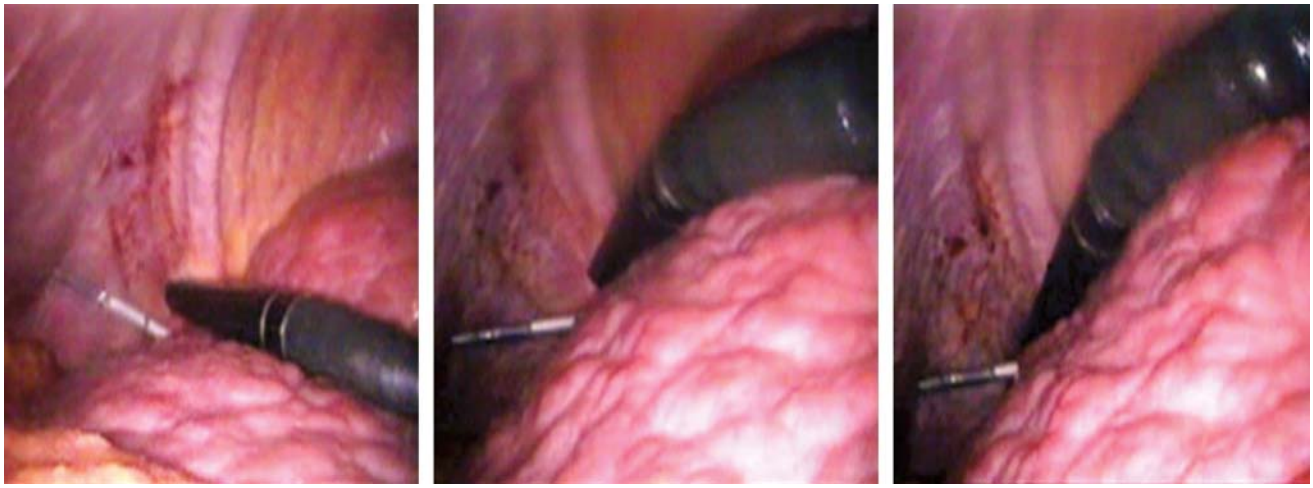

Fig. 4: The tip of the needle was advanced under ultrasound guidance to the proximal edge of the lesion

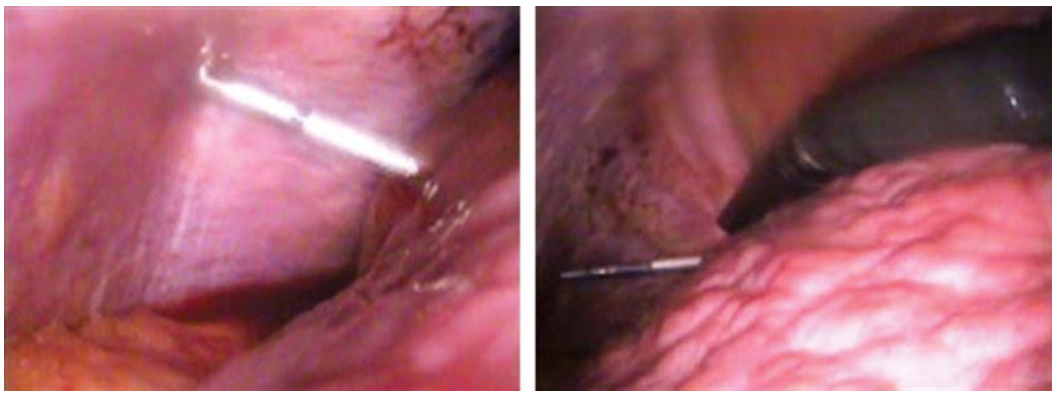

Fig. 5: The curved electrodes were advanced step-by-step to full deployment

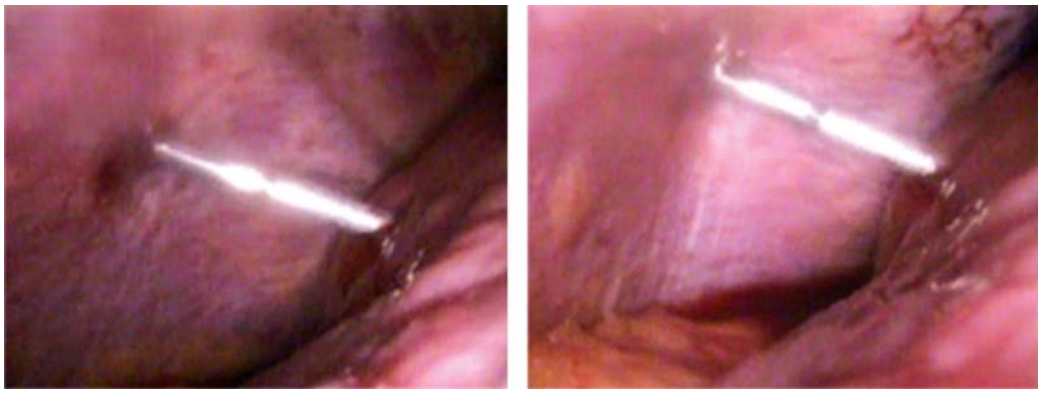

Fig. 6: Coagulation of the needle track

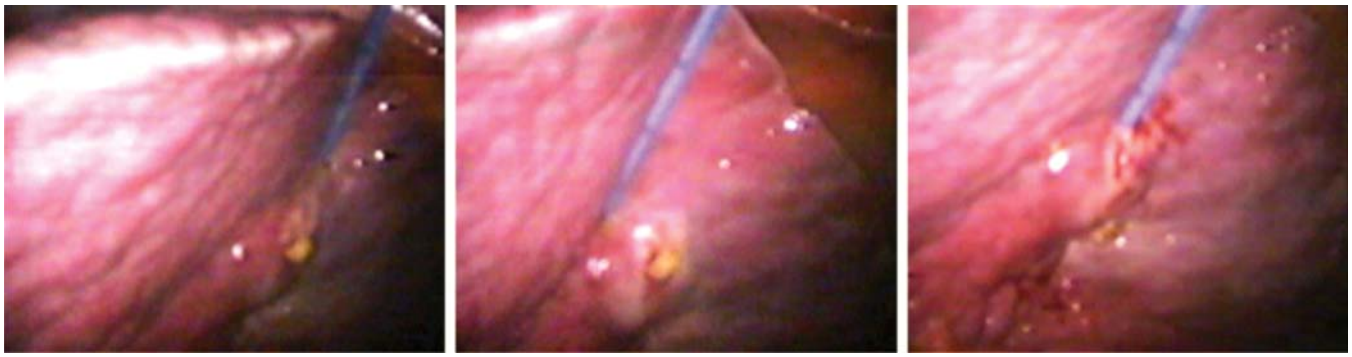

Fig. 7: For larger tumors, multiple ablations were needed to be overlapped to build a composite thermal lesion with sufficient size to kill the entire tumor and to provide 0.5-1 cm tumor-free margin

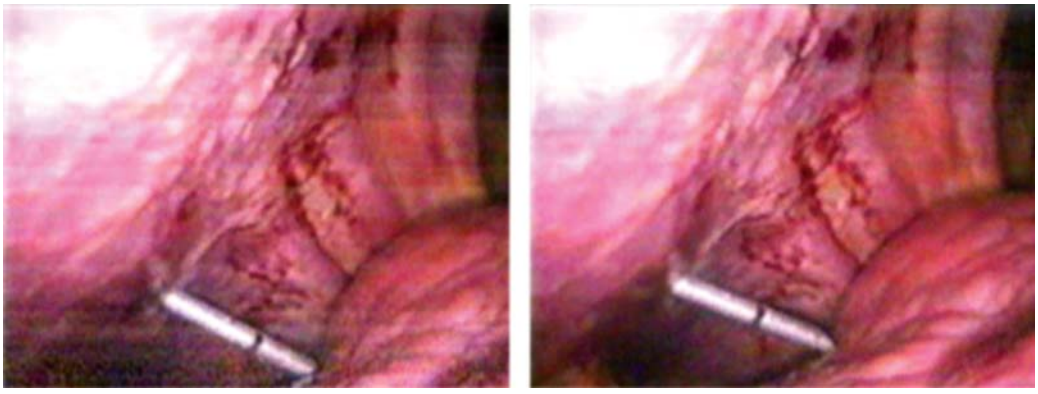

Fig. 8: The deepest ablations were performed before the superficial ones to minimize the possibility of microbubbles that might obscure visualization of the deepest portions of the tumor

especially if there has been any contact with the tumor, (Fig. 7). The deepest ablations were performed before the superficial ones to minimize the possibility of microbubbles that might obscure visualization of the deepest portions of the tumor and thus prevent completion of the ablation (Fig. 8). In case of tumours bulging on liver surface, the hilar portion of the tumor was ablated initially in order to destroy the inflow of blood supplying the tumor (Fig. 9).

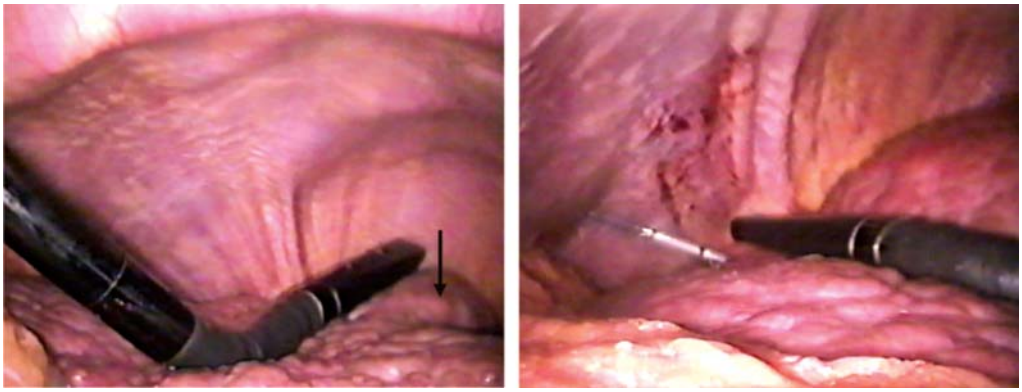

Fig. 9: In case of tumors bulging on liver surface, the hilar portion of the tumor was ablated initially in order to destroy the inflow of blood supplying the tumor

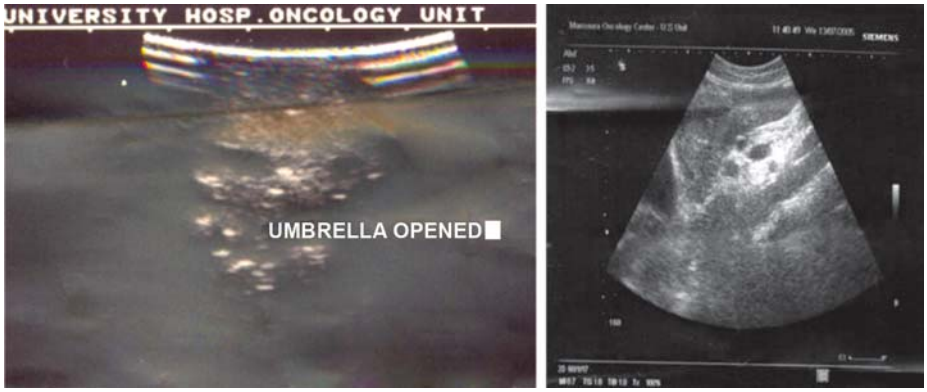

Fig. 10: Intraoperative US monitoring: Picture to the left showing RF Needle's umbrella opened inside the tumor. The one to the right shows the tissues after ablation

Intraoperative Ultrasound Monitoring

The ultrasound probes used as a guide for any residual lesion, it allows measure the zone of increased echogenicity corresponding to the coagulation of the tissues (Fig. 10).

Ending RFA Treatment

After complete ablation of the tumour was achieved, the arrays were completely retracted. The needle track was ablated as the needle electrode was withdrawn, and then the needle electrode was removed. The skin incisions were closed by sutures, sterilized and dressed. Patients were allowed to recover.

Postablation Care

All patients were observed for 24 hours in the surgery department to detect any acute complications and to start IV fluid. IV antiemetic was given as all patients experienced post-ablation nausea. Strong IV analgesics were given to control pain as pethidine hydrochloride 50 mg (pethidine) or tramadol hydrochloride 50 mg (tramadol). Prophylactic IV antibiotic were started, amoxicillin-clavulanic acid (augmentin) or ceftazidine (fortum), and metronidazole, and continued for 24 hours. Before leaving the surgery department US examination was performed to the patients to detect any collection. The patient was allowed to eat within 24 hours.

Follow-up

All patients were followed for 24 months for: Hospital stay; Procedure related complications; Early pos-tablation complications (first month); Tumour volume response; Tumour marker response; Late complications; Tumour recurrence and distant metastases; Two years–over all survival and disease free survival.

Statistical Methods

Data was analyzed using SPSS (Statistical Package for Social Sciences) version 10. Qualitative data was presented as number and percent. Comparison between groups was done by Chi-square test or Fisher's exact test (FET). Kolmogrov – Smirnov test, tested quantitative data for normality. Normally distributed data was presented as mean + SD. Student t- test was used to compare between two groups. Non-parametric data was presented as min – max and median. Mann-Whitney test was used for comparison between groups. $P < 0.05$ was considered to be significant.

RESULTS

This series involved 63 patients from ages 32 to 64 years, all of whom presented to OCMU for RFA. 46 males and 14 females (Table 1). Thirty patients were managed with percutaneous RFA (PRFA group), and 33 patients were planned to manage with laparoscopic ultrasound guided RFA (on clinical, laboratory and radiological bases), but IOUS reveal that the tumour in three patients were not candidate for RFA as it invade important pedicle and thus excluded from the study. Thus, each group was of 30 patients.

The preoperative clinical, laboratory and radiological findings in the studied groups were summarized in Tables 2 and 3: The most common site was the right lobe (n = 44); both lobes were affected in two patients (3.33%). Tumours affect one segment (n = 48), or two segments (n = 12). Tumours sizes were less than 3 cm (n = 12) or 3 – 5 cm (n = 48). Child's – A (n = 16) or B (n = 44).

Intraoperative US do not change the operative plan except in three patients that were excluded from the study (Table 4).

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Hospitalization period, procedure related and early postoperative complications reported in the first month were significantly less in LUSRFA group, (Table 5). The average hospital stay was 1.2 days (vie 3 days with PRFA), skin burn (n = 4), internal haemorrhage (n = 4) and Acute liver failure (n = 4) were reported only with PRFA, all were treated conservatively. Liver abscess reported in four cases (2 with LURFA and 2 with PRFA). Early hospital mortality (n = 4) reported only with PRFA.

The late outcomes of this series are reported in Tables 6 to 10. There was insignificant decrease in tumour volume in all patients (Figs 11 to 13). While significant decrease in level of tumour marker alpha-fetoprotein was reported more with LUSRFA (80% vie 53.3% with PRFA group), p- value was highly significant 0.033. There were 28 deaths (16 with PRFA and 12 with LUSRFA). Less local recurrence, and distant metastases were reported with LUSRFA (13.33% and 6.67% vie 26.67% and 13.33% with PRFA). The overall survival was more with LUSRFA (60% vie 46.67%); also 2 years disease-free survival was more with LUSRFA (53.33% vie 40% with PRFA group) (Table 10).

Our study found that 75% of patients with Child-Pugh stage – A , and 83.33% of patients with tumour size less than 3 cm, survived for 2 years, from them 29/32 (90.63%) has single lesion (Table 11).

DISCUSSION

The outcomes of this series of LUSRFA and PRFA performed by OCMU were equivalent to those in the surgical literature.[11-17]

The high rate of morbidity and mortality may be due to bad liver conditions and early learning course.

Procedure related complications represent 10% (6.67% with PRFA and 3.33% with LRFA), these included skin burn (n = 4), one patient developed a third-degree skin burn during the tract-ablation portion of a percutaneous procedure (this required debridement and wound care), and port site hernia (n = 2). De Baere, et al.[11] reported a total of 25 adverse events with radio-frequency ablations that performed percutaneously on 312 patients. Wood et al.[12] reported skin burn in (8%) of patients after RFA.

Early major complications occurred within 30 days of the RF ablation represent 20% (all with PRFA), these included internal haemorrhage (n = 4), acute liver failure (n = 4) and liver abscess (n = 4), that was successfully treated with percutaneous drainage ± endoscopically placed internal biliary stent. Livraghi

TABLE 1: Patients characteristics

Items	*Group I (PRFA)*	*Group II (LUSRFA)*	*Total*	*P-value*
Total Number	*30*	*30*	*60*	
Sex:				
= Male	24(80%)	22 (73.3%)	46 (76.67%)	0.66
= Female	6(20%)	8 (26.7%)	14 (23.33%)	
Age (Years):				
= Mean ± SD	52.3 ± 8.7	55.4 ± 6.6	53.9 ±7.6	0.284
= Range	32-64	42-64	32-64	

TABLE 2: Preoperative clinical, laboratory and radiological finding in the studied groups

Items		*Group I (PRFA)*	*Group II (LUSRFA)*	*Total*	*P-value*	
Total number		*30*	*30*	*60*		
Presentations:						
= Right hypochondrial pain		14 (46.67%)	24 (80%)	38 (63.33%)	0.05	
= Bleeding per gums		6 (20%)	6 (20%)	12 (20%)	1.0	
= Epistaxis		6 (20%)	4 (13.33%)	10 (16.66%)	0.7	
= Varices		2 (6.67%)	0	2 (3.33%)	0.3	
= Dyspepsia		2 (6.67%)	0	2 (3.33%)	0.3	
Biochemical Finding:						
= Albumin gm/dl (mean)		3.1	2.7	2.9 ± 0.4	0.000	
= Bilirubin mg/dl (mean)		1.3	0.9	1.1 ± 0.22	0.000	
= PPT seconds (mean)		32	33	32.5 ± 0.8	0.322	
= Transaminases IU% (median)		90	62	76		
= α-fetoprotein IU% (median)		307	362	334.5		
Viral markers:						
= HBs AG		4 (13.33%)	2 (6.67%)	6 (10%)	0.543	
= HCV		24 (80%)	28 (93.33%)	52 (86.67%)	0.283	
= HBs AG+HCV		4 (13.33%)	2 (6.67%)	6 (10%)	0.543	
Tumor	= One segment affected:	22	26	48		
	o Left lobe:	6	8	14		
	– Segment 2	2 (6.67%)	0	2 (3.33%)		
	– Segment 4	4 (13.33%)	8 (26.67%)	12 (20%)		
	o Right lobe:	16	18	34		
	– Segment 5	2 (6.67%)	6 (20%)	8 (13.33%)	0.37	
	– Segment 6	6 (20%)	8 (26.67%)	14 (23.33%)	0.143	
	– Segment 7	2 (6.67%)	2 (6.67%)	4 (6.67%)	0.309	
	– Segment 8	6 (20%)	2 (6.67%)	8 (13.33%)	0.143	
	= Two Segments	8	4	12		
	o Left and right lobes:	2	0	2		
	– Segment 4 and 7	2 (6.67%)	0	2 (3.33)		
	o Right lobe:	6	4	10		
	– Segment 5 and 7	4 (13.33%)	0	4 (6.67%)		
	– Segment 5 and 8	2 (6.67%)0	0	2 (3.33%):··		
	= Tumor size:					
	• Less than 3 cm.	8 (26.67%)	4 (13.33%)	12 (20%)		0.361
	• 3 – 5 cm	22 (73.33%)	26 (86.67%)	48 (80%)	0.361	
	= Tumour Numbers:					
	• Single.	22 (73.33%)	26 (86.67%)	48 (80%)	0.361	
	• Two	8 (26.67%)	4 (13.33%)	12 (20%)	0.361	

TABLE 3: Preoperative clinical TNM staging and child-Pugh classification in the studied groups

Items	*Group I (PRFA)*	*Group II (LUSRFA)*	*Total*	*P-value*
Total number	*30*	*30*	*60*	
Clinical staging (TNM):				
• I	24 (80%)	26 (86.67%)	50 (83.33%)	0.830
• II	4 (13.3%)	2 (6.67%)	6 (10%)	
• IIIa	2 (6.67%)	2 (6.67%)	4 (6.67%)	
Child's-Pugh classification:				
• A	6 (20%)	10 (33.33%)	16 (26.67%)	0.4
• B	24 (80%)	20 (66.67%)	44 (73.3%)	

TABLE 4: Correlation of laparoscopic finding and IOUS with preoperative imaging in LUSRFA group

Items	*Group I (PRFA)*	*Group II (LUSRFA)*	*Total*
Total number	*30*	*33*	*63*
Preoperative imaging:			
• Candidate for RFA	30	33	63
• Not candidate	0	0	0
Laparoscopic finding:			
• Candidate for RFA	–	33	33
• Not candidate	–	0	0
Laparoscopic and IOUS finding:			
• Candidate for RFA	–	30	30
• Not candidate	–	3	3

TABLE 5: Early postoperative course (first one month)

Items	*Group I (PRFA)*	*Group II (LUSRFA)*	*Total*	*P-value*
Total number	*30*	*30*	*60*	
Hospitalization period:				
= Mean time (days)	3	1.2	2.6	0.048
= Range (days)	2-5	1-2	1- 5	
Procedure related complications				
1. Port site hernia	0	2 (6.67%)	2 (3.33%)	
2. Skin burn	4	0	4	0.048
Early postoperative complications				
1. Internal haemorrhage	4	0	4	0.021
2. Ascites	10 (66.67%)	4 (13.3%)	14 (23.33%)	0.035
3. Acute liver failure	4 (13.33%)	0	4 (6.67%)	0.048
4. Liver abscess	2 (6.67%)	2 (6.67%)	4 (6.67%)	
5. Pleural effusion	4 (13.33%)	0	4 (6.67%)	0.048
Early hospital mortality	4 (13.33%)	0	4 (6.67%)	0.048

TABLE 6: Tumor volume response

Response	*Group I (PRFA)*	*Group II (LUSRFA)*	*P-value*
Number	*30*	*30*	
Partial response	2 (6.6%)	4 (13.3%)	
Minor response	18 (60%)	22 (73.3%)	
Stable disease	4 (13.3%)	4 (13.3%)	
Progressive disease	6 (20.0%)	0	
Overall response	20 (66.6%)	26 (86.6%)	
Mean tumor volume:			
• Before treatment (cm^3)	3.13 ± 0.8	3.90 ± 1.0	0.085
• After treatment (cm^3)	2.74 ± 0.7	2.73 ± 0.9	

TABLE 7: Tumor marker response

Response	*Group I (PRFA)*	*Group II (LUSRFA)*	*P-value*
Number	*30*	*30*	
Complete response	0	8 (26.6%)	
Partial response	12 (40%)	12 (40%)	
Minor response	4 (13.3%)	4 (13.3%)	
Stable disease	6 (6.6%)	6 (20%)	
Progressive disease	8 (26.6%)	0	
Overall response	16 (53.33%)	24 (80%)	
Mean value (U/ml):			
• Before treatment	307.47	362.8	0.033*
• After treatment	223.8	87.96	
P-value	0.098	0.005	

** Is significant.*

TABLE 8: Late postoperative complications

Items	*Group I (PRFA)*					*Group II (LUSRFA)*					
Initial number	*20*					*30*					
Time	*>1-6 ms*	*6-12 ms*	*12-18 ms*	*18-24 ms*	*Total*	*>1-6 ms*	*6-12 ms*	*12-18 ms*	*18-24 ms*	*Total*	*P- value*
Clinical evaluation:											
1. Liver failure	4	2	2	4	12	2	0	0	0	2	0.013
2. Ascites	4	2	2	4	12	2	4	0	4	10	0.563
3. Pleural effusion	0	0	2	0	2	0	0	0	0	0	0.043
4. Varicea	2	6	4	0	12	0	4	0	0	4	0.0431
5. Tumour seedling	0	0	0	0	0	0	0	0	0	0	
Deaths	4	2	2	4	12	2	4	6	0	12	

TABLE 9: Local recurrence and distant metastases

Items	*Group I (PRFA)*	*Group II (LUSRFA)*	*Total*	*P-value*
Number of patients	*30*	*30*	*60*	
Local recurrence:	8 (26.67%)	4 (13.33%)	12 (20%)	0.032
Distant Metastases:	4 (13.33%)	2 (6.67%)	6 (10%)	0.043
• Pulmonary	2 (6.67%)	2 (6.67%)	4 (6.67%)	
• Bony	2 (6.67%)	0	2 (3.33%)	

TABLE 10: Two years disease-free and overall survival

Items	*Group I (PRFA)*	*Group II (LUSRFA)*	*Total*	*P- value*
Number of patients	*30*	*30*	*60*	
No. of deaths in the first month	4 (13.33%)	0	4 (6.67%)	
Local recurrence	8 (26.67%)	4 (13.33%)	12 (20%)	0.032
Number of late deaths:	12 (40%)	12 (40%)	24 (40%)	
• Deaths due to local recurrence	6 (20%)	2 (6.67%)	8 (13.337%)	
• Deaths due to other causes	6 (20%)	10 (33.33%)	16 (26.67%)	
Overall deaths	16 (53.33%)	12 (40%)	28 (46.67%)	0.045
Overall survival	14 (46.67%)	18 (60%)	32 (53.33%)	0.049
Disease free survival	12 (40%)	16 (53.33%)	28 (46.67%)	0.042

TABLE 11: Relation between the survival and Child-Pugh stage, size and number of primary tumor

Items	*Number*	*24 months Deaths*	*24 months Survival*
Number of patients	*60*	*28*	*32*
= Child – Pugh classification:			
• A	16	4 (25%)	12 (75%)
• B	44	24 (54.55%)	20 (45.45%)
= Tumor size:			
• Less than 3 cm	12	2 (16.67%)	10 (83.33%)
• 3 –5 cm	48	26 (54.17%)	22 (45.83%)
= Tumor number:			
• Single	48	19 (39.58%)	29 (60.42%)
• Two	12	9 (75%)	3 (25%)

et al [13] reported that: major complications represent 2.2%. These included acute liver cell failure, intraperitoneal hemorrhage, and Hepatic abscesses. De Baere, et al[11] reported that with radio-frequency ablations performed on 312 patients: Hepatic abscesses occurred in 7 patients, despite the administration of an extended antibiotic prophylaxis regimen.

In our study hospital mortality occurred in 4 (6.67%) patients (all with PRFA). The fatalities were attributed to acute liver failure. In a major study by De Baere, et al,[11] the mortality rate for the RF ablations of a total of 350 cases, was 1.6%. The fatalities were attributed to portal vein thrombosis, liver failure, and colonic perforation. The high rate of hospital mortality may be due to bad liver conditions.

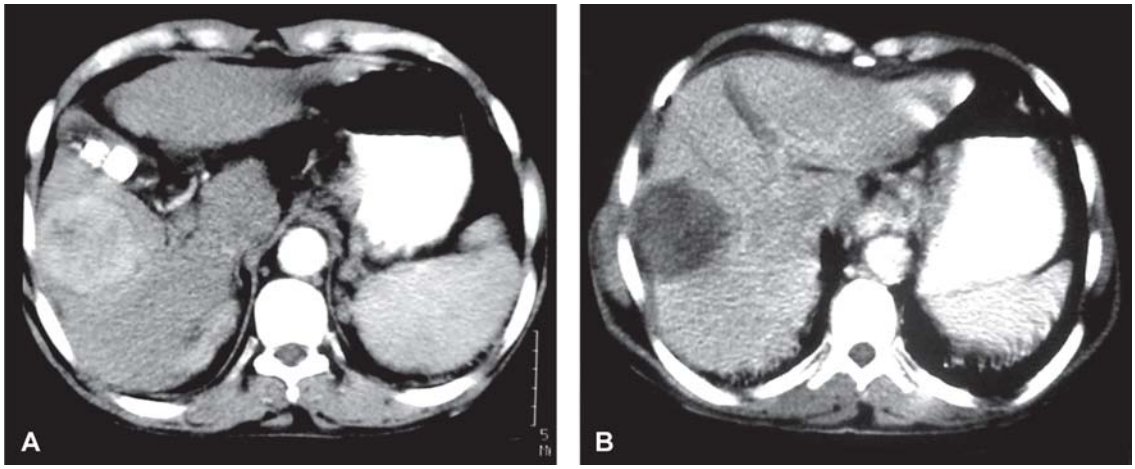

Fig. 11: CT-before and after RFA (minor response)

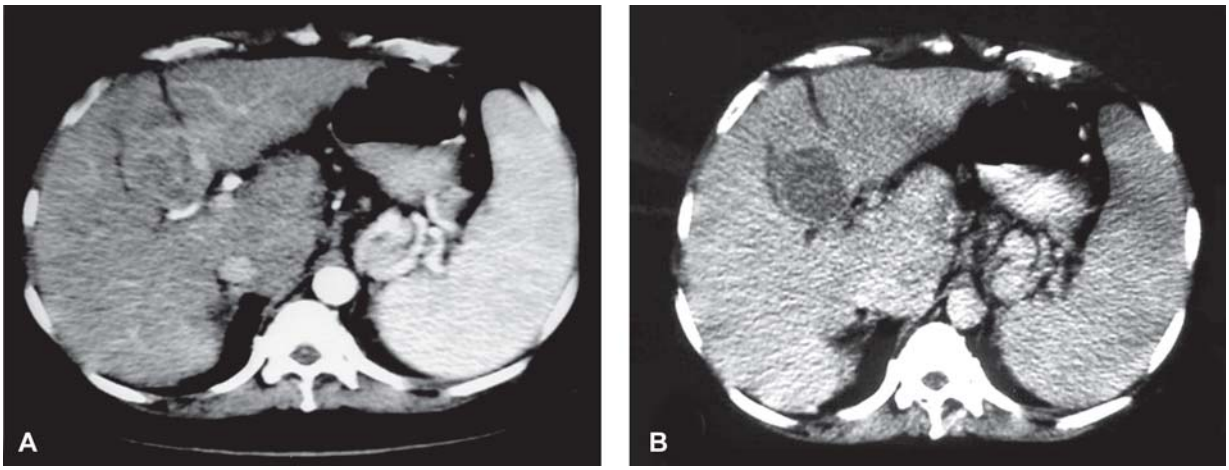

Fig. 12: CT-before and after RFA (minor response)

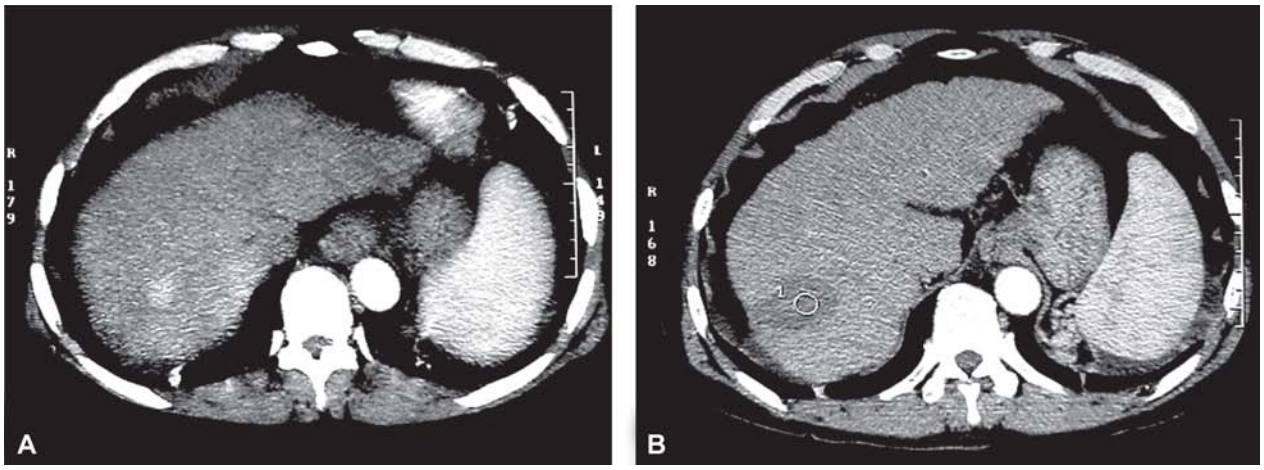

Fig. 13: CT-before and after RFA (minor response)

In our study no tumor seedling along the electrode track occurred. Livraghi, et al[14] reported 0.5% tumour seedling along the electrode track, the majority of these cases were noted in poorly differentiated HCC that had previously undergone large needle biopsy procedures. Appropriate maneuvers can be adopted to minimize them. These include indirect puncture of the tumour by the RF electrode through non-tumourous liver parenchyma.

In our patients local recurrence reported in 12 (20%) patients (8 with PRFA and 4 with LUSRFA) (treated with re-ablation with radiofrequency) and distant metastases reported in 10% (4 with PRFA and 2 with LUSRFA). Dominiqu et al [15] reported local recurrence rates of 5.7% for the 227 RFAs. Ashraf et al[16] reported overall recurrence of 65 % within 3 years period.

The 2 years overall and disease-free survival were 53.33% and 46.67% (60% and 53.33% with LUSRFA and 46.67% and 40% with PRFA). The cause of death was local recurrence in 28.57% and cardiopulmonary and cachexia in 71.43%. Vivarelli et al, [17] found that : The 1-year overall and disease-free survival rates were 78% and 60%. While the 3-year overall and disease-free survival rates were 33% and 20%. Ashraf, et al[16] reported Disease-free survival rates of 54.6% at 1 year and 27.3% at 2 years and 20% at 3 years, respectively.

Our study found that 75% of patients with Child-Pugh stage – A , and 83.33% of patients with tumour size less than 3 cm, survived for 2 years, from them 29/32 (90.62%) has single lesion. Vivarelli, et al[17] found that: The survival benefit was more evident for Child-Pugh class-A patients and for patients with a single tumour of less than 3 cm in diameter.

CONCLUSION

- LUSRFA is a safe and effective treatment for unresctable hepatic malignancies with both curative and palliative role. It may replace hepatic resection in the management of resectable liver tumours in selected cases.
- Percutaneous RFA should be reserved for patients who cannot undergo general anesthesia and those with smaller lesions sufficiently isolated from adjacent organs.
- *LUSRFA has many advantages over PRFA* : (1) It allows patients assessment for radiographically occult, unresectable disease and thus avoiding unnecessary surgical intervention. (2) Some of RFA limitations can be overcome by its laparoscopic application as in cases of subdiaphragmatic lesions in which percutaneous application carry the risk of diaphragmatic thermal injury. (3) Laparoscopic ultrasonography provides better declaration of the number and location of liver tumours. (4) It allows direct visual control of the RFA procedure; exposure and isolation of the liver from surrounding tissue; allow handling of intraoperative bleeding; ablation of several lesions during one operation; fast recovery time; and short hospital stay. (5) Followed by less local recurrence, and distant metastases than percutaneous RFA.

Practice Recommendations

- *Tissue-energy interactions for RFA can be improved by:* (A) Increasing energy deposition, by cooling tissues nearest the probe. (B) Improving tissue heat conduction by injection of saline, which spreads thermal energy further and faster. (C) Increasing tumour sensitivity to heat by cellular hypoxia or prior tumour damage by radiotherapy or chemotherapy. (D) Decrease heat loss. (E) Reducing blood flow during ablation therapy by embolotherapy before ablation.
- *Several complications can be minimized or even avoided by:* (1) Avoid RFA in cases with tumours that are in close proximity (1 cm) of other viscera. (2) Premedication with intravenous antibiotics to decrease the occurrence or even the severity of hepatic abscesses and peritonitits. (3) Applying RF around the electrode track to avoid tumor

seedling, as well as bleeding. (4) Applying RF prior to any needle or array repositioning, especially if there has been any contact with the tumor.

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Effect of Endoscopic Thyroidectomy via Anterior Chest Wall Approach on Treatment of Benign Thyroid Tumors

Mingliang Wang, Tao Zhang, Zhihai Mao, Feng Dong, Jianwen Li, Aiguo Lu, Weiguo Hu, Lu Zang Yu Jiang, Minhua Zheng

Shanghai Minimally Invasive Surgery Center, Surgery Department of Shanghai Ruijin Hospital affiliated to Shanghai JiaoTong University Medical School, Shanghai, China

Abstract

Objective: To evaluate the inflammatory response and acid-base equilibrium index, as well as other clinical facts of the endoscopic thyroidectomy via the anterior chest wall approach.

Methods: 39 patients who received thyroidectomy in our surgical center during September 2007 and January 2008 were included in this study. Twenty of the patients underwent an endoscopic surgery, and the rest 19 received a conventional surgery. These patients' data were compared within and between treatment groups with respect to clinical facts and inflammatory evaluations. Arterial blood gas data and electrolyte data were analyzed within the endoscopic group.

Results: Endoscopic thyroidectomy group showed shorter operative time compared to that of conventional thyroidectomy group, although the difference didn't reach statistical significance. No significant difference regarding postoperative hospital stay was observed between two groups. Postoperative day 1 shows much higher values of IL-6 and TNF than that measured preoperative or postoperative day 3 in both groups. CRP appeared to be significantly increased postoperatively in both groups, although no difference between the two groups was found. Although blood cortisol significantly increased in both groups postoperatively, the data of endoscopic group postoperative day 1 was lower than the same day of conventional group. Arterial blood gas analysis showed that both PCO_2 and TCO_2 were statistically different between preoperation and 30 min after insufflation. No insufflation complication was observed.

Conclusion: Compared with conventional thyroid surgery, endoscopic thyroidectomy via anterior chest wall approach presented with no significant difference in respect of both clinical facts and laboratory outcomes.

Keywords: Surgery; endoscopy; thyroidectomy; anterior chest wall approach; inflammatory response; arterial blood gas analysis; electrolyte.

INTRODUCTION

Ever since the endoscopic thyroidectomy was originated and developed, this operation has been favoured world widely with its excellent clinical and cosmetic outcomes. However, this operation requires insufflation of CO_2, which may impair acid-base equilibrium. Moreover, the dissection of skin flap is more extensive than conventional thyroidectomy. All these concerns have been obsessing the surgeons whether it will cause more damage to the human body than the conventional one.

Our study tries to analyze and compare the differences between the endoscopic thyroidectomy and the conventional thyroidectomy in respect of inflammatory response, arterial blood gas (ABG) evaluation, as well as durations of operational time and postoperational hospital stay.

PATIENTS AND METHODS

Thirty-nine (39) patients with benign thyroid diseases, hospitalized in our surgical centre during September 2007 and January 2008 were included in this study, preoperatively diagnosed by ultrasonography, including solitary nodule (16 cases), multiple cysts (5) and multiple nodules (18). No concomitant disease was found. These patients were non-randomly treated in either endoscopic method or conventional procedure on account of the tumor diameter (< 5 cm), age (not necessary excluding criteria but recommended in relatively young patients) and their own requests. Patients received either unilateral or bilateral subtotal lobectomy according to their state of lesions. Postoperative paraffin section indicates benign tumor in all patients, including 21 cases of nodular goiter, 18 adenoma including 2 with cystoid degeneration. No postoperative complications were observed, and no analgetics were applied after surgery.

We used 4-6 mmHg CO_2 to sustain the operative space.

Parametric data were evaluated by T-test and ANOVA analysis.

RESULTS

Clinical Facts

Among these 39 patients, 20 received an endoscopic thyroidectomy via the anterior chest wall approach and 19 were treated by a conventional thyroidectomy. The average age was 37.1 ± 9.12 years old (range from 17 to 55) in the endoscopic group (EG), and 43.2 ± 11.6 years old (20-63) in the conventional group (CG) (Table 1).

TABLE 1: Patient characteristics

	EG	*CG*
Gender		
Male	3	5
Female	17	14
Age (years)		
Mean (SD)	37.1(9.12)	43.2 (11.6)
Range	17-55	20-63
Diagnosis		
Nodular goiter	10	11
Adenoma	10	8

EG: Endoscopic Thyroidectomy Group, CG: Conventional Thyroidectomy Group.

Durations of Operation and Postoperative Hospital Stay

The mean operative time (OT) of the endoscopic group was 98.5 ± 28.97 min, while that of the conventional group was 111.84 ± 34.98 min. The mean postoperative hospital stay (PHS) of the endoscopic group was 3.50 ± 0.61 days, and that of the conventional group was 3.63 ± 0.68. No statistical significant differences on these durations were observed between two groups (Table 2).

TABLE 2: Durations of operation and postoperative hospital stay (Mean ± SD)

	EG	*CG*	*p-value*
OT (min)	98.5 ± 28.97	111.8 ± 34.98	0.177
PHS (day)	3.5 ± 0.61	3.6 ± 0.68	0.433

OT: Operative Time, PHS: Postoperative Hospital Stay.

Acid-base Equilibrium Index

Arterial blood gas analysis was carried out for every patient who received the endoscopic thyroidectomy preoperation (right after intubation), 30 minutes post insufflation, and right after the surgery (Table 3).

Inflammatory Index

The venous blood was taken from every patient the day before operation, postoperative day 1 and day 3. These blood samples were analyzed for IL-6, TNF, CRP and cortisol (cortisol samples were strictly taken at a regular time, we choose 6 AM, in case of any possible influence caused by nyctohemeral rhythm) (Table 4 to 7).

TABLE 4: IL-6 (ug/dl)

	Preoperative	*Postoperative day 1 [1]*	*Postoperative day 3 [1]*
EG (Mean ± SD)	4.2 ± 0.48	7.2 ± 0.50*	4.6 ± 0.30
CG (Mean ± SD)	4.4 ± 0.72	7.2 ± 0.26*	4.5 ± 0.28
p-value [2]	0.320	0.830	0.300

1. Values from postoperative day 1 and day 3 were compared with that from preoperative measurement. * p-value < 0.05.
2. p-values are from comparisons between CG and EG at each measurement point.

TABLE 3: Acid-base equilibrium index for patients in EG (Mean ± SD)

	Preoperative	*30 min after Insufflation*	*Postoperative*	*p-value*
PH	7.36 ± 0.13	7.37 ± 0.07	7.36 ± 0.34	0.439
PCO_2 (mmHg)	45.67 ± 7.92	48.75 ± 7.58	45.41 ± 8.32	0.016
PO_2 (mmHg)	556.60 ± 102.32	532.22 ± 105.72	554.80 ±104.84	0.247
BE	2.87 ± 0.97	2.29 ± 0.24	2.36 ± 0.34	0.096
SaO_2 (%)	100 ± 0	99.86 ± 0.53	100 ± 0	0.336
TCO_2 (mmol/L)	28.02 ± 2.02	29.21 ± 2.39	27.64 ± 2.92	0.012
HCO_3^- CO_2^- (mmol/L)	27.00 ± 2.44	26.67 ± 2.76	27.76 ± 2.11	0.059
Na^+(mmol/L)	138.02 ± 4.45	138.14 ± 3.99	137.29 ± 8.53	0.076
K^+(mmol/L)	3.85 ± 0.49	3.85 ± 0.51	3.843 ± 0.53	0.962
ICa^{2+}(mmol/L)	1.144 ± 0.05	1.138 ± 0.09	1.148 ± 0.04	0.661

TCO_2 and PCO_2 increased statistical significantly during insufflation. No insufflating complications as pneumohypoderma or acid-base equilibrium disorder were observed.

TABLE 5: TNF (ug/dl)

	Preoperative	*Postoperative day 1 [1]*	*Postoperative day 3 [1]*
EG (Mean ± SD)	9.9 ± 1.49	11.31 ± 1.90*	10.48 ± 1.18
CG (Mean ± SD)	9.97 ± 2.04	11.71 ± 1.62*	10.44 ± 1.36
p-value [2]	0.110	0.320	0.580

[1] Values from postoperative day 1 and day 3 were compared with that from preoperative measurement. *p-value < 0.05.
[2] p-values are from comparisons between CG and EG at each measurement point.

TABLE 6: CRP (ug/dl)

	Preoperative	*Postoperative day 1 [1]*	*Postoperative day 3 [1]*
EG (Mean ± SD)	0.36 ± 0.03	1.11 ± 0.14*	0.48 ± 0.05*
CG (Mean ± SD)	0.45 ± 0.03	1.03 ± 0.11*	0.72 ± 0.8*
p-value [2]	0.950	0.420	0.054

[1] Values from postoperative day 1 and day 3 were compared with that from preoperative measurement. *p-value < 0.05.
[2] p-values are from comparisons between CG and EG at each measurement point.

Table 2.7: Cortisol (ug/dl)

	Preoperative	*Postoperative day 1 [1]*	*Postoperative day 3 [1]*
EG (Mean ± SD)	7.36 ± 1.26	8.2 ± 0.86*	9.07 ± 0.85*
CG (Mean ± SD)	7.79 ± 0.91	10.6 ± 1.2*	10.14 ± 0.78*
p-value [2]	0.43	0.03	0.56

[1] Values from postoperative day 1 and day 3 were compared with that from preoperative measurement. *p-value < 0.05.
[2] p-values are from comparisons between CG and EG at each measurement point.

DISCUSSION

Since the establishment of our minimally invasive surgery centre in 2003, we've successfully carried out more than 170 endoscopic thyroid operations via the anterior chest wall approach. After the originating period, the physician learning curve gradually drives to stability. According to the analysis of about 100 patients who received endoscopic thyroidectomy during 2004 and 2006, the mean operative duration was 93.5 min. In our study, we reported similar endoscopic thyroidectomy operative duration (98.5 min), which was 13 minutes shorter than the mean operative time in the conventional thyroidectomy. The small size of this study limited the statistical power to show the significance of the difference. There was no difference of postoperative hospital stay between patients received endoscopic thyroidectomy and conventional thyroidectomy. No postoperative complication was observed in this study. All these clinical data can prove that this kind of operation has inclined towards maturity. Reviewing the history of all 174 patients treated with endoscopic thyroid surgery in our center, 6 patients presented with hoarseness after surgery, 5 were transient, only one permanent recurrent laryngeal nerve damage who was then recovered by taking neurosuture, 4 of these 6 patients were confirmed by pathological examination as thyroid carcinoma, including the permanent damage one, the other 2 were nodular goiters.

The insufflation pressure of sustaining the operative space had already been verified through many laboratory and clinical researches.[1,2] Bellantone and Rubinos,[1,3] animal experiment proved that low pressure (<10 mmHg) of CO_2 insufflation in the anterior neck region had no obvious negative effect on circulation and blood-flow dynamics. Recently, the generally recommended insufflation pressure is 4-6 mmHg, it can absolutely provide an ideal operative space for the surgeons. Our research showed only TCO_2 and PCO_2 increased statistically during insufflation, but came back to baseline value right after desufflation. TCO_2 consists of two parts, one is HCO_3^-, (occupies 95% of the consistence of TCO_2) and the other is soluble CO_2. The unchanged $THCO_3^-$ explains the increase of soluble CO_2. And soluble CO_2 can sufficiently be compensatory by mechanical ventilation. The stable acid-base index, the rapid recovery of TCO_2 and PCO_2 and the absence of insufflation complication can best prove that 4-6 mmHg of insufflation will not cause any irreversible damage to human body.

Studies comparing endoscopic surgery and related conventional surgery have been carried out universally with consistent conclusions. Researches focused on inflammatory responses after laparoscopic surgery involve not only general but also focal responses. Due to the insufflation of CO_2, the pH value is suppressed focally in the operative field,[4-6] but not in general system. The acid circumstances can than lead to focal immune suppression and reduce inflammatory response. IL-6, TNF and CRP, the general measurement for acute inflammatory response, indicate the degree of surgical damage.[7,8] Blood cortisol is widely accepted as the suppressor of inflammatory response, which can decrease IL-6, TNF and CRP generations.

Our study found that TNF and IL-6 increased significantly on postoperative day 1 and recovered to preoperative level on postoperative day 3 in both groups. There was no difference of IL-6 or TNF between the two groups at any measurement point. CRP is an acute-phase protein, which increased significantly after surgery. But there was no difference between two groups either. It was reported that the increasing concentration of CO_2 in the blood can inhibit the releasing of blood cortisol.[9] In our study, blood CO_2 transiently increased during endoscopic surgery, and meanwhile the blood cortisol in the endoscopic

group appeared to be lower than that in the conventional group on postoperative day 1. Because of the suppressive effect on TNF and IL-6 of cortisol, it can reversely prove that TNF and IL-6 level of endoscopic group is no higher than that of conventional group. All these outcomes above manifested that endoscopic thyroidectomy would neither enhance the inflammatory response nor damage human function, despite its extensive dissection of skin flap.

Compared with conventional thyroid surgery, endoscopic thyroidectomy via anterior chest wall approach presented with no significant difference in respect of inflammatory responses, acid-base index, and duration of operative time and postoperative hospital stay. These data support the safety and feasibility of this procedure in treatment of benign thyroid tumors. And in the light of its cosmetic advantage, more and more patients who are suffering from thyroid diseases will get benefit from this technology.

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Comparison in Terms of Postoperative Morbidity and Hospital Stay between Open Cholecystectomy and Laparoscopic Cholecystectomy

[1]Rooh-ul-Muqim, [2]Faryal Gul Afridi, [2]Javeria Iqbal, [3]Jehangir Akbar, [2]Zahoor Khan, [4]M Zarin [2]Samiullah, [5]Mohammad Aziz Wazir

[1]Assistant Professor, Surgical D Unit, Khyber Teaching Hospital, Peshawar, Pakistan
[2]Resident, Surgical D Unit, Khyber Teaching Hospital, Peshawar, Pakistan
[3]Surgical D Unit, Khyber Teaching Hospital, Peshawar, Pakistan
[4]Senior Registrar, Surgical D Unit, Khyber Teaching Hospital, Peshawar, Pakistan
[5]Professor and Incharge, Surgical D Unit, Khyber Teaching Hospital, Peshawar, Pakistan

Correspondence: Faryal Gul Afridi, Resident Surgical D Unit, Khyber Teaching Hospital, Peshawar, Pakistan
E-mail: faryal.afridi@yahoo.com

Abstract

Type of study: Comparative.

Aim: To compare the postoperative morbidity in terms of post-operative pain, gait disturbances, wound and respiratory infections along with length of hospital stay in patients undergoing laparoscopic cholecystectomy with those undergoing open surgery for symptomatic gallstone disease to compare the effectivity of minimally invasive surgery with open surgery in reducing postoperative morbidity and thus length of hospital stay.

Place and duration of study: Surgical Unit Khyber Teaching Hospital, Peshawar, Pakistan; from July 2006 to December 2006.

Materials and methods: This study included a total of 50 patients who underwent either open or laparoscopic cholecystectomy in our unit (SDW KTH). Their clinical data, admission dates and date of surgery were noted. Postoperative progress was followed and requirement of analgesia, nausea, vomiting, febrile morbidity, wound infections and respiratory tract infections, if any were noted. Their date of discharge from hospital was also recorded. Re-admission (if any) for any complication of surgery was noted and further days spent in hospital were recorded. This data was analyzed to see the post-operative morbidity and length of hospital stay in these patients.

Results: Out of the 50 patients included in this study, the mean hospital stay for the patients who underwent laparoscopic cholecystectomy was 2.06 days as against 3.93 days for those having open surgery for symptomatic gallstone disease. Also pain (and thus analgesia requirement) and other complications were significantly lower for the patients who had minimally invasive surgery indicating the superiority of laparoscopic technique as regards postoperative hospital stay and morbidity.

Conclusion: Minimally invasive surgery is infact very effective in reducing postoperative morbidity and thus hospital stay in patients with gallstones. Although open cholecystectomy is still performed in our hospitals, the time is near when it will be largely replaced by the laparoscopic technique.

Keywords: Laparoscopic cholecystectomy; minimally invasive surgery; open cholecystectomy; hospital stay.

INTRODUCTION

Cholecystectomy is one of the most frequently performed operations. Open cholecystectomy (OC) has been the gold standard for over 100 years. Laparoscopic cholecystectomy (LC) was introduced in the 1980s.[1] Since its foundation, laparoscopic cholecystectomy has become the procedure of choice for symptomatic gallstone disease.[2] Although both of these procedures are fairly well tolerated, wound infection remains the most common postoperative complication which not only prolongs hospital stay, increases cost of treatment but can also lead to long-term complications.[3] LC is highly praised and demanded by patients due to less pain, shortened hospital stay and diminished disability. LC abolishes the trauma and transient ileus that follows open surgery, thus patients are free of postoperative pain and there is requirement of analgesia.[4] A minimal impact on immune system, minimal exposure to external environment, carbon dioxide pneumoperitoneum, better visualization of tissues for dissection and hemostasis reduces the frequency of infections and other morbidity in patients undergoing LC.[3] Thus, aim of this study was to observe and compare the postoperative morbidity in terms of pain, GI upsets,

wound infections and duration of hospital stay in patients undergoing LC and OC.

MATERIALS AND METHODS

This study was conducted in Surgical D Unit Khyber Teaching Hospital, Peshawar from July 2006 to December 2006. One hundred two symptomatic cases of gallstone disease presented to the unit in these 6 months out of which 50 cases were included in the study as the rest did not fit into the inclusion criteria and were thus excluded. Inclusion criteria was: (1) Patients with symptomatic gallstone disease only, (2) Patients with normal or near normal BMI (up to 10 kg over the ideal BMI was considered near normal), (3) Non-pregnant. Exclusion criteria included: (a) Past history of surgery especially in the upper abdomen, (b) Diabetes mellitus or any other co-morbid condition, e.g. hypertension, CAD/IHD, peripheral vascular disease, chronic lung condition, etc. which may hamper postoperative progress, (c) Patients using oral contraceptives, steroids or any other medication which may have a bearing on the postoperative recovery.

Patients admitted both as emergency and OPD were included and their clinical data was obtained on pre-formed proformas. Their date of admission, date of surgery and the surgical procedure they underwent were noted. All operations were performed by senior consultant surgeons or senior residents under supervision. Postoperatively the patients were followed for their requirement of analgesia, time of mobilization, tolerance of oral feeds, signs of infection (e.g. fever, chest infection, wound infection) and their date of discharge from hospital was also recorded. The patients were followed for upto 4 weeks for any complications. From this data mean hospital stay, frequency of analgesic requirement, chest infection, febrile morbidity, mobilization and discharge with return to activity were calculated to compare the difference between the two groups. Most important parameter that was closely followed was wound infection in the two groups. Wound infection was graded as follows:

1. *Grade I:* skin and superficial subcutaneous tissue infection only requiring wound dressing.
2. *Grade II:* Deep subcutaneous tissue infection requiring antibiotics, drainage of pus and dressings with prolonged hospital stay.
3. *Grade III:* Widespread infection or systemic infection requiring hospitalization and I/V antibiotics.

RESULTS

Hospital Stay

Out of the 50 patients who were included in the study, 15(30%) patients underwent open surgery, 31(62%) had laparoscopic cholecystectomy and 4(8%) patients were those in which an attempt at laparoscopic cholecystectomy was made which failed and they were converted to open cholecystectomy. Of these 2 patients had severely distorted anatomy of the Calot's triangle making dissection impossible, and in 2 cases there was iatrogenic injury to the cystic artery and cystic duct (1 case each).

Thirty-one patients had laparoscopic cholecystectomy, out of which 7 (25.9%) patients had a 1 day postoperative hospital stay, 14 patients (45.16%) stayed 2 days in the hospital, 7 (25.9%) had a 3 days hospital stay, 2 (7.4%) had 4 days stay, and only 1 (3.7%) had a 5 days stay in the hospital (this patient had a slight biliary leak which stopped by itself by the 5th postoperative day). The mean hospital stay in these patients thus came out to be 2.06 days. The patients who underwent open surgery had a 2-day hospital stay in only 1 patient (6.66%), 4 patients (26.6%) stayed 3 days in the hospital, 6 (40%) had a stay of 4 days, and 3 (20%) had a hospital stay of 5 days. Only 1 patient stayed for 6 days in the hospital (6.66%). The mean in this group came out to be 3.93 days of postoperative hospital stay, which is significantly higher than the laparoscopy group. The 4 cases converted to open from laparoscopic form showed variable lengths of hospital stay, i.e. 1 had a 5 day stay, 7 days in two and 25 days in one patient. Mean stay came out at 11.25 days in this group. Only the patient who had iatrogenic injury to the cystic duct had a prolonged hospital stay of 25 days and even she was discharged on the 6th postoperative day, but she returned a day later with biliary leak from wound site and had to be re-admitted. Except this, all the rest had uneventful postoperative recoveries with no complications.

Postoperative Morbidity

The other parameters of postoperative progress that we considered also showed a clear advantage of LC over OC. Pain was significantly lower in the LC group with 18 patients (58.06%) having mild pain, 12 (38.7%) having moderate pain and only 1 case (3.22%) complaining of severe pain requiring analgesia for 2 days. Severe pain requiring prolonged analgesia was seen in 3 cases (15.7%) of OC, 14 (73.68%) having moderate pain and 2 (10.5%) having mild pain. Fever was noted in 5 cases of OC (26.31%) as against only 1 case (3.22%) of LC. Wound infection was not seen in any patients with LC and 11 cases (57.8%) of OC, whereas 2 cases (10.5%) of OC showed grade 1 infection and 1 case each (5.2%) of grade 2 and 3 infections were seen. 4 cases of OC (21%) and 2 cases (6.45%) showed mild chest infection. Mild GIT disturbances (nausea, vomiting, etc.) were seen in all patients in the immediate postoperative period and in no case later than 6 hours post-op. 3 patients (15.7%) with OC had prolonged vomiting and required I/V anti-emetics.

DISCUSSION

Gallstones are a major cause of surgical morbidity as well as admissions.[5] The estimated prevalence of GS disease in Pakistan is 15%[6] and may be responsible for 22% admissions in a surgical unit.[7]

Since the introduction of laparoscopic cholecystectomy (LC) in 1987, numerous advances have been made in the technique. LC has been shown to be safe for the emergency treatment of acute cholecystitis.[8] In this era of increasing minimally invasive surgery, conversion to open in cases of difficult dissection may prove a difficult task for the exclusively laparoscopic surgeon.[9]

Age is one of the critical factors affecting the morbidity and mortality rates after open cholecystectomy in both acute and chronic cholecystitis (Table 1).[10, 11] Increasing age in patients undergoing open cholecystectomy has been associated with increased length of hospital stay as well (Table 2).[12] In a retrospective study by Jatzko GR, Lisbog PH and associates age has been identified as the only significant factor in increasing the morbidity rate after laparoscopic cholecystectomy as well (Table 3).[13] Julio Mayol and his associates have, however, shown that Laparoscopic cholecystectomy is safe in the aged (even above 70 years) for symptomatic gallbladder disease and is associated with a short hospital stay, low rates of readmissions and recurrent biliary surgery.[14] Age has never been a contraindication for laparoscopic cholecystectomy,[15] although initially this approach was reserved for low-risk patients.[10]

In addition to the traditional four-port technique, three trocars (ports) and even two trocars are used to perform LC [16,17] along with using mini-instruments, authors of these new techniques claim that these techniques take a similar time to perform and cause less postoperative pain than the standard laparoscopic cholecystectomy.[16,18]

Trihac in his prospective trial addressed the safety and advantages of the three port technique in terms of analgesia requirement[19] and found no improvement in the postoperative hospital stay. In a comparison study by Dhafir Al-Azawi and associates Diclofenac and pethidine were the most commonly used postoperative analgesics prescribed after LC.[20] Patients who underwent three-port LC needed lesser pethidine than those who underwent four-port LC however diclofenac use did not relate to the technique used.[21] The operating time was also lower in the three-port technique. So the introduction of the three-port technique means patients need fewer pain-killers, shorter hospital stays (2.8 vs 3.7), fewer scars and most cost savings; it has however its own shortcomings and should only be attempted by experienced surgeons.[21]

Our study also reports a very low incidence of postoperative complications. However, despite the fact that we have reported a very low complication rate, there is always an element of doubt as regards patient feedback. This may be secondary to many reasons, e.g. (1) Most of the patients presenting to KTH come from far flung areas, especially from Afghanistan, with poor access to tertiary care facilities so that some may have reported to local doctors if/when any complication arose, (2) general habit of ignoring mild/moderate problems due to financial and/or social limitations.

U Berggren and associates had noted that although laparoscopic cholecystectomy has rapidly become established as the treatment of choice for cholelithiasis there is very little evidence to support the claimed benefit to patients and they tried, with success in their study to prove its effectiveness as in their study the mean duration of hospital stay and sick leave was significantly longer in patients who underwent open surgery for GS.[22] Same results have been obtained in our study.

J Wenner and his associates compared the financial aspects of both these procedures and reported a 10% lower hospital cost in patients who had laparoscopic surgery with lesser number of days off work (14 versus 35 in open cholecystectomy) showing laparoscopic cholecystectomy to be more cost-effective.[23] Although we did not compare the costs of these two procedures, the reduced hospital stay itself is an indicator of its cost-effectivity (as patients spend lesser time and thus lesser resources in the hospital and report back earlier to their jobs). However, Kory Jones and his associates argued that surgeons should feel comfortable in converting from laparoscopic to open cholecystectomy in cases of tedious dissection as it does not

TABLE 1: Age and sex distribution

Charachteristic		*Open cholecystectomy n = 19(15+4*)*		*Laparoscopic cholecystectomy n = 31*	
		No.	*%*	*No.*	*%*
Sex	Male	3	15.7	3	15.7
	Female	16	84.2	28	90.3
Age	< 20 years	0	0	2	6.45
	21-30 years	1	5.2	3	9.6
	31-40 years	8	42.1	13	41.9
	41-50 years	9	47.3	10	32.25
	51-60 years	1	5.2	2	6.45
	> 60 years	0	0	1	3.22

*Cases converted to OC after failed attempt at LC.

TABLE 2: Hospital stay

No. of days	*Open cholecystectomy n = 19(15+4*)*		*Laparoscopic cholecystectomy n =31*	
	No.of cases	*%*	*No. of cases*	*%*
Day care	0	0	7	22.58
1-2 Days	1	5.2	14	45.16
2-3 Days	4	21	7	22.58
3-4 Days	6	31.5	2	6.45
4-5 Days	4 (3+1*)	21	1	3.22
>5 Days	4 (1+3*)	21	0	0

*Cases converted to OC after failed attempt at LC.

TABLE 3: Postoperative morbidity

Characteristic		*Open cholecystectomy n = 19(15+4*)*		*Laparoscopic cholecystectomy n=31*	
		No. of pts.	*%*	*No. of pts.*	*%*
Pain	Severe	3	15.7	1	3.22
	Moderate	14 (10+4*)	73.68	12	38.7
	Mild	2	10.52	18	58.06
Fever		5	26.31	1	3.22
Wound infection	Nil	11	57.89	0	0
	Grade I	2	10.52	0	0
	Grade II	1	5.2	0	0
	Grade III	1	5.2	0	0
Chest infection		4	21.05%	2	6.45%
GIT disturbances Vomiting		3 cases of severe	15.7%	Nil	Nil

*Cases converted to OC after failed lC.

prolong the hospital stay much.[24] Theodoros Syrakos and associates however argued that mini-laparotomy (small incision) technique was better than both open and laparoscopic cholecystectomy showing that morbidity was similar in both open and laparoscopic groups in their study (3.8%) while it was only 0.8% in the mini-lap group. Operating time was also significantly shorter (46 mins) in this group as compared to open and LC (61 mins). Hospital stay was longer for open cholecystectomy group but a very small difference was seen in the LC and mini-lap patients (2.5 vs 2.7 days). They thus questioned whether the claimed benefits of laparoscopic cholecystectomy were enough to justify the use of this procedure which has a significantly higher cost.[25]

Although we have established the reduced hospital stay after laparoscopic cholecystectomy in our patients, an analysis of its cost-effectiveness is necessary especially taking into account the limited resources our people have.

CONCLUSION

As evidenced by our results and results of papers published elsewhere, laparoscopic cholecystectomy does indeed have a significant bearing on smoother postoperative progress of the patient, requiring lesser analgesia and causing earlier mobilization and earlier discharges from hospitals. Thus, laparoscopic cholecystectomy should be considered as the procedure of choice in patients with symptomatic gallstone disease as it decreases postoperative morbidity and hospital stay significantly.

ABBREVIATIONS

Pre-op: Preoperative
SDW-KTH : Surgical D Ward, Khyber Teaching Hospital
GIT : Gastrointestinal tract
BMI : Body mass index
CAD : Coronary artery disease
IHD : Ischemic heart disease
DM : Diabetes mellitus
HTN : Hypertension
PVD : Peripheral vascular disease
CLD : Chronic lung disease
OC : Open cholecystectomy
LC : Laparoscopic cholecystectomy
GS : Gallstones
GB : Gallbladder

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Elective Laparoscopic Left Colectomy for Diverticular Disease: A Monocentric Study on 205 Consecutive Patients

[1]João Odilo Gonçalves Pinto, [1]Basmah Fallatah, [1]Phillipe Espalieu, [1]Gilles Poncet, [2]Alvine Bissery [1]Jean-Claude Boulez

[1]Department of General and Digestive Surgery, Edouard Herriot Hospital, University Claude Bernard Lyon 01–Lyon, France
[2]Department of Biostatistics, Hospices Civils de Lyon, University Claude Bernard Lyon 01 – Lyon, France

Correspondence: Pr Jean-Claude Boulez. Hôpital Edouard Herriot, Service de Chirurgie Digestive–Pavillon D4, Place d'Arsonval, 69437 Lyon CEDEX 03, Telephone : +33 472110107, Fax: +33 472116252
E-mail: jean-claude.boulez@chu-lyon.fr

Abstract

This study was aimed to analyze the outcomes of laparoscopic colectomy for diverticular disease performed over a 17 year period at a single institution. Between April 1990 and May 2007.

Keywords: Diverticular disease; laparoscopic colectomy; diverticulitis.

MATERIALS AND METHODS

Population

Between April 1990 and May 2007, a total of 210 elective laparoscopic colonic resections for diverticular disease were performed at the D4 Unit of General and Digestive Surgery at the Edouard Herriot Hospital – Lyon, France. This study included the 205 left colectomy procedures comprising 185 sigmoidectomies (90, 24%) and 20 left hemicolectomies (9,76%). The three right colectomies and two total colectomies were excluded.

Patients were first referred for surgical consultation either from the gastroenterology department consultants, the community physicians or the emergency department. Pertinent information was then collected in a comprehensive sheet throughout preoperative consultations, subsequent hospitalizations and postoperative follow-up. Data were later entered into a computer database and updated every time new information was obtained. Those included the patient's antecedents, mode of presentation, surgical indications, preoperative work-up, details of the operative procedure, complications, hospital stay, mortality and follow-up results.

Usual surgical indications were: (1) after a documented diagnosis of complicated diverticulitis either acute or chronic (abscess, perforation, fistula, stenosis); (2) after the second non-complicated acute attack of diverticulitis; (3) after the first non-complicated acute attack of diverticulitis in special situations such as the patient aged < 50 years and immunosuppressed patient; (4) diverticular disease complicated with bleeding; (5) diverticular disease with associated lesions of surgical treatment such as the colonic neoplasms. Although uniformly followed in our surgical unit, those indications varied along the years and could be anticipated or postponed according to the medical consultants' referrals. After an episode of complicated diverticulitis, whether or not an invasive procedure was needed, an interval of at least one month was respected before the elective operation was scheduled (Table 1).

Surgical Technique

A total laparoscopic operative technique was used in which a stapled intra-abdominal anastomosis is made. The resected specimen is removed through a small prolongation of a 12 mm left lower quadrant (LLQ) trocar incision, occasion that is profited to place a circular stapler anvil into the descending colon stump at the same time. The stapler is then passed through the anus to complete the anastomosis after closing the small incision and re-establishing the pneumoperitonium. Some variations were tried at the beginning of the experience with the removal incision being used either to insert a hand-port (15 cases) or to manually perform the anastomosis in a laparoscopic-assisted technique (7 cases). The procedure is performed with the surgeon placed on the right side of the patient and with the aid of four trocars. In 158 (77,07%) cases, it was judged necessary to release the splenic flexure of the colon. In those occasions, the procedure was started with the surgeon placed between the legs of the patient and an additional 5 mm trocar could be placed. An aspirative drain was placed most of the time (96,1% of cases) and a protection colostomy was rarely necessary (03 cases).

The steps sequence of the operation are as follows: (1) release of the splenic flexure of the colon (when necessary

TABLE 1: Indications for surgery

		Nr. patients	*%*
Non-complicated acute diverticulitis*		164	80
Complicated diverticulitis (acute or chronic)		37	18.05
	Abscess (10) Peritonitis/Perforation (4) Fistula (6) Stenosis (17)		
Bleeding diverticular disease*		4	1.95
Total		**205**	**100**

for descending the proximal colonic stump after an adequate resection); (2) systematic identification of the left ureter with placement of a provisory landmark; (3) medial mesocolic dissection for ligature of the left colonic vessels as appropriate; (4) distal dissection and division of the rectum sufficiently below the rectosigmoid junction; (5) liberation of the descending colon by a lateral approach; (6) exteriorization and transection of the left colon through a small LLQ incision and insertion of the stapler anvil; (7) closure of the small incision and completion of the anastomosis intra-abdominally after restablishing the pneumoperitonium.

Statistical Analysis

A statistical logistic univariate and multivariate model was built trying to identify possible risk factors for adverse outcomes in the population studied. Multiple different variables were tested for its effects over the rates of conversion, complications, re-operation and postoperative functional disorder. The Fisher's exact test was used for qualitative variables analysis, Student t-test for quantitative variables analysis and Mann and Whitney test for non parametric variables analysis. To build logistic multivariate analysis, only variables which were statistically significant in univariate model ($p < 0.1$) were kept. Results for logistic multivariate model are presented as odds-ratio. All statistical analysis were done using Stata 10.0 software (Stata Corp LP, College Station, TX).

RESULTS

Preoperative

Patients were 107 (52.2%) women and 98 (47.8%) men with a median age of 60 (30-90) years. There were 46 (22.4%) subjects aged ≤ 50 years. The mean BMI was 25.3 (± 3.5) kg/m^2 with obese patients (BMI ≥ 30) representing 11.7% of the population studied.

Antecedents of past abdominal surgery were noted in the majority (60%) of the patients. The most frequent previous scars founded were those of appendectomy (n = 28), diverse laparotomies (n = 31), both appendectomy and laparotomy (n = 30) and Pfannestiel (n =13). Comorbidities included diabetes in 12 (5.8%) and steroid therapy in 6 (2.9%) of subjects with 79% being ASA classification 1 or 2, 13.1% of ASA 3 and only 0.5% of ASA 4.

The median time from the onset of symptoms was 15 (1-240) months, with a median of 2 (0-12) previous acute attacks and a median of 1 (0-4) previous hospitalizations for acute attacks. The most frequent surgical indication was for non-complicated acute diverticulitis (80%), acute or chronic complicated diverticulitis (18.05%) and bleeding diverticular disease (1.9.5%) (Table 1). The complicated diverticulitis consisted of stenosis (n = 17), abscess (n = 10), fistula (n = 6) and peritonitis/perforation (n = 4).

Preoperative studies used were contrast enema (95.6%), colonoscopy (84.8%), ultrasonography (77%) and CT scan (72.7%).

Causes of conversion, risk factors and complications of the surgery is presented in Table 2 to 9.

Operative

Associated lesions were presented 40 (19.51%) of patients. Those consisted of gallbladder stones (n = 15); benign colonic neoplasms (n = 12); hernias of the abdominal wall (n = 5); adnexal masses (n = 4); colon cancer (n= 1); Meckel's diverticulum (n = 1); renal cyst (n = 1) and a cyst of the biliary tract (n = 1). Intraoperative adhesions were noted in 36 (17.56%) cases.

There were 10 intraoperative complications (Table 10).

TABLE 2: Causes of conversion (n= 12, 5.85%)

Causes	*Nr. of patients*
Failure of dissection due to inflammatory adhesions	9
Colonic injury*	1
Tear of rectal stump below anastomosis	1
Repair of injury in the right external iliac artery*	1

*During dissection of the inflammatory process

TABLE 3: Postoperative complications

Type	*Nr*	*Management*
Anastomotic stenosis	9	Endoscopic dilatation (05 cases) Open reoperation (04 cases)
Paralytic Ileus	6	Conservative
Incisional hernia	5	Open repair
Pelvic collection	4	Conservative (01 case) Radiological drainage (02 cases) Laparoscopic re-operation (01 case)
Fistula	3	Open re-operation – Hartmann procedure
Obstruction due to adhesions/bands	3	Conservative (01 case) Open reoperation (02 cases)
Fecal incontinence	2	Conservative
Missed small bowel injury	1	Laparoscopic reoperation
Missed large bowel injury	1	Open reoperation – Hartmann procedure
Abdominal wall hematoma	1	Conservative
Abdominal pain with obstipation	1	Laparoscopic reoperation
Urinary tract infection	1	Medical
Pulmonary embolism	1	Medical
Septicemia	1	Medical
Rectorragie	1	Conservative
Pancreatitis	1	Medical
Sexual dysfunction	1	Conservative
Total	**42**	

TABLE 4: Risk factors studied in univariate analysis for postoperative complications

	Postoperative complications		
	Yes (n = 40)	*No (n =165)*	*p-value***
Age (yrs)	62.2 ± 11.6	58.6 ± 11.7	0.084
BMI (kg/m²)	25.2 ± 3.9	25.3 ± 3.41	0.828
Steroid therapy	0	6 (3.9%)	0.349
Past abdominal surgery	26 (65%)	97 (59.5%)	0.524
Time from onset of symptoms (yrs)	31.3 ± 36.5	37.9 ± 45.6	0.792*
Complicated diverticulitis	6 (15%)	31 (18.8%)	0.654
Previous acute attacks (≤ 2)	26 (65%)	96 (63.2%)	0.829
Past urgent treatment	2 (5.3%)	8 (5.1%)	1.000
Associated lesions	6 (15%)	34 (21.4%)	0.508
Adhesions	5 (12.5%)	31 (19.5%)	0.365
Intraoperative complication	3 (7.5%)	7 (4.2%)	0.414
Conversion	4 (10%)	8 (5%)	0.261
Associated procedure	10 (25%)	56 (35%)	0.229
Total length of the procedure (min)	226.4 ± 63.3	204.6 ± 55.0	0.031
Length of the colectomy (min)	209.3 ± 59.8	191.4 ± 48.2	0.049

* Mann and Whitney test
** Student t-test or Fisher exact test

TABLE 5: Risk factors studied in multivariate analysis of postoperative complications

	Odds ratio	*SE*	*p-value*
Age (yrs)	1.029	0.0165	0.07
Length of the colectomy (min)	1.006	0.0033	0.064

TABLE 6: Risk factors studied in univariate analysis for conversion

	Conversion		
	Yes (n=12)	*No (n =189)*	*p-value***
Age (yrs)	68 ± 10.9	58.6 ± 11.5	0.006
BMI (kg/m²)	24.7 ± 3.3	25.4 ± 3.5	0.56
Steroid therapy	1 (9.1%)	5 (2.7%)	0.297
Past abdominal surgery	10 (83.3%)	112 (59.6%)	0.132
Time from onset of symptoms (yrs)	34.7 ± 32.3	36.7 ± 44.7	0.57*
Complicated diverticulitis	4 (33.3%)	33 (17.5%)	0.24
Previous acute attacks (≤ 2)	8 (66.7%)	114 (60.3%)	0.8
Past urgent treatment	2 (18.2%)	8 (4.4%)	0.103
Associated lesions	1 (9.1%)	39 (20.7%)	0.697
Adhesions	2 (18.2%)	34 (18.1%)	1
Intraoperative complication	3 (25%)	7 (3.7%)	0.016
Associated procedure	3 (27.3%)	63 (33.3%)	1

* Mann and Whitney test
** Student t-test or Fisher exact test

TABLE 7: Risk factors studied in multivariate analysis of conversion

	Odds ratio	*SE*	*p-value*
Age (yrs)	1.091	0.0378	0.012
Intraoperative complication	18.65	17.34	0.002
Past urgent treatment	4.46	4.27	0.119

TABLE 8: Risk factors studied in univariate analysis of postoperative functionnal disorder

	Post-operative functional disorder		
	Yes (n =18)	*No (n =183)*	*p-value***
Age (yrs)	59.4 ± 11.7	59.1 ± 11.7	0.926
BMI (kg/m²)	25.4 ± 3.5	25.3 ± 3.5	0.923
Steroid therapy	0 6 (3.4%)	1	
Past abdominal surgery	14 (77.8%)	108 (59.4%)	0.204
Time from onset of symptoms (yrs)	31.5 ± 37.9	37.1 ± 44.6	0.7219*
Complicated diverticulitis	1 (5.6%)	36 (19.7%)	0.205
Previous acute attacks (≤ 2)	12 (66.7%)	110 (60.1%)	0.801
Past urgent treatment	1 (5.6%)	9 (5.1%)	1
Associated lesions	8 (44.4%)	32 (17.7%)	0.012
Adhesions	2 (11.1%)	34 (18.8%)	0.537
Intraoperative complication	1 (5.6%)	9 (4.9%)	1
Conversion	1 (5.6%)	10 (5.5%)	1
Associated procedure	9 (50%)	57 (31.3%)	0.120
Total length of the procedure (min)	213.9 ± 49.3	208.9 ± 58.3	0.727
Length of the colectomy (min)	185.2 ± 38.6	196.1± 52.2	0.390
Length of the associated procedures (min)	28.7 ± 35.4	12.9 ± 29.2	0.0213*

* Mann and Whitney test
** Student t-test or Fisher exact test

TABLE 9: Risk factors studied in multivariate analysis of postoperative functional disorder

	Odds ratio	*SE*	*p-value*
Associated lesions	3.19	1.7	0.029
Length of the associated procedures (min)	1.0088	.0064851	0.173

TABLE 10: Intraoperative complications (n = 10, 4.89%)

Complication	*Nr*	*Management*
Tear of the mesocolon	1	Laparoscopic repair
Colonic injury	3	Conversion for repair (01 case) Laparoscopic repair (02 cases)
Inferior mesenteric artery injury	1	Laparoscopic repair
Superficial epigastric vessels injury	1	Laparoscopic repair
Hypogastric artery injury	1	Laparoscopic repair
External iliac artery injury	1	Conversion for ligature
Left ureter injury	1	Laparoscopic repair
Tear of rectal stump below anastomosis	1	Conversion for repair
Total	**10**	

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Common Bile Duct Injury in Laparoscopic Cholecystectomy: Inherent Risk of Procedure or Medical Negligence—A Case Report

[1]Lalwani S, [2]Misra MC, [3]Bhardwaj DN, [4]Rajeshwari S, [5]Rautji R, [6]Dogra TD

[1]Assistant Professor, Department of Forensic Medicine, AIIMS, New Delhi, India
[2]Professor and Head, Department of Surgery, AIIMS, New Delhi, India
[3]Additional Professor, Department of Forensic Medicine, AIIMS, New Delhi, India
[4]Additional Professor, Department of Anaesthesia, AIIMS, New Delhi, India
[5]Associate Professor, Department of Forensic Medicine, AFMC, Pune, India
[6]Professor and Head, Department of Forensic Medicine, AIIMS, New Delhi, India

Correspondence: Sanjeev Lalwani, Assistant Professor, Department of Forensic Medicine, AIIMS, New Delhi, India
E-mail: drsalal@rediffmail.com, sanjulalwani2001@yahoo.com

Abstract

We present a case report of common bile duct injury which occurred in a patient who underwent laparoscopic cholecystectomy for cholecystitis and cholelithiasis. The patient died within 96 hours of the surgery. The case was investigated by the police as the relations of the victim alleged death due to negligence on the part of treating doctors. The clinical details, autopsy findings, report of histopathological examination and medicolegal aspects are discussed along with relevant literature.

Keywords: Cholecystectomy; common bile duct injury; negligence.

INTRODUCTION

For more than a century classical cholecystectomy has been a method of choice in surgical management of gallbladder disease. Laparoscopic cholecystectomy introduced in the late eighties, has now become the gold standard and has taken the place of conventional cholecystectomy.[1] It is now the treatment of choice for symptomatic gallstone disease.[2,3] Though it is a very safe procedure, it does have its own morbidity and rarely mortality due to numerous complications.[4]

CASE REPORT

A 44-year-old male patient presented to a private hospital with the complaints of acute onset of pain in the right upper abdomen for two days with 4-5 episodes of yellowish vomiting. He was examined by a surgeon and admitted to the hospital on the next day. As per clinical records, there was a history of dyspepsia with acid brash. The pain was radiating to right hypochondrium and back. There was no history of jaundice and diarrhea. On clinical examination, his general condition was satisfactory with stable vitals. The central nervous system, cardiovascular system and respiratory system were normal on examination. Abdominal examination showed slight tenderness in the right hypochondrium. There was no organomegaly or free fluid. Ultrasonography revealed acute cholecystitis with cholelithiasis. Laboratory investigations were within normal limits.

Laparopscopic cholecystectomy was performed on the next day of admission under general anesthesia. During the surgery gallbladder was found to be thick walled with dense omental adhesions. The Hartmann's pouch was not well developed. Gallbladder was sessile and Moynihan's lump was present.

During dissection the common bile duct was accidentally injured at the junction of gallbladder. The injury was identified immediately during the procedure. A second opinion of other senior consultant was sought and it was decided to convert the procedure to open through a right subcostal incision. The injury to common bile duct was repaired and a no. 12 T tube was placed across the repair. Gallbladder was dissected out of its bed, haemostatis achieved, suction irrigation done and a no. 32 chest drain tube placed in the subhepatic region. The incision was closed in layers. The patient was shifted to the surgical ICU. The gallbladder was sent for histopathological examination. There was no anesthetic complication during the entire procedure. On the first and second postoperative day patient was afebrile and stable hemodynamically. He was kept on intravenous fluids, antibiotics, analgesics and proton pump inhibitors. Oral feeding was withheld.

On the third postoperative day patient developed oliguria. Urine output failed to respond to a fluid challenge. The opinion of a physician was sought and the patient was shifted to Medicine ICU. A diagnosis of cholangitis with septicemia and

associated pancreatitis was made. Computerized Tomography of abdomen did not reveal any leakage from the T tube as the dye was passing smoothly from CBD into duodenal loop without any extravasation. Patient was kept on intravenous fluids, antibiotics, vasopressor support and was placed on ventilator. Central line was inserted. Blood was sent for culture and sensitivity test, Serum amylase and serum lipase. ECG and X-rays were done. Arterial Blood Gas analysis showed severe metabolic acidosis.

The investigations revealed deranged clotting parameters and high level of serum amylase and serum lipase. A vasopressin infusion was started and sodium bicarbonate was administered to correct acidosis. Consultation was sought from senior nephrologists. Non-contarst Computerized Tomography of abdomen was done which was normal. Patient was on dalacin, amikacin and vancomycin. The coagulation abnormality was corrected with one unit of Fresh Frozen Plasma and one unit of platelets. He was started on Xigris (Activated Protein C) on fourth postoperative day. Despite these measures the patient's condition continued to deteriorate. In the morning hours of the fifth postoperative day, the patient developed cardiac arrest. Cardiopulmonary resuscitation was attempted with adrenaline, atropine and sodium bicarbonate but was unsuccessful and the patient was declared dead.

The relatives of the deceased lodged a complaint at the police station alleging negligence in the treatment by the doctors. The inquest was conducted by police and autopsy was performed by the board of doctors.

Autopsy findings revealed stitched wounds on right and left side of chest with injection marks (Therapeutic Central Venous Line insertion site), Stitched wound 24 cm in length on anterior abdominal wall (Stitched Surgical Incision), stitched wound around umbilicus (Therapeutic) and injection marks in both side inguinal and both side cubital fossa. Internally, stitched surgical wound on first part of duodenum. CBD was attached to first part of duodenum. Gallbladder was absent. Gel foam present in gallbladder fossa. Both lungs were congested and edematous. Petechial hemorrhages were seen on surface of lungs and liver. Heart shows subendocardial petechial hemorrhages. There was no evidence of pericardial, pleural effusion or hemoperitoneum. *Histopathological examination* indicated congestion in spleen, fatty change in liver, severe pulmonary edema and hemorrhage in lungs and acute tubular necrosis of proximal tubules of kidneys.

Cause of death was attributed to multiple organ failure due to septicemia following cholecystectomy.

DISCUSSION

Professional negligence is defined as absence of reasonable care and skill or willful negligence of a medical practitioner in the treatment of a patient, which causes bodily injury or death of patient. A doctor is not liable if he exercises reasonable skill and care, provided that his judgment conforms to accepted medical practice and does not result in an error of omission. The doctor cannot be sued for professional negligence, when statistics show that accepted methods of treatment have been employed on the patient and that the risk and injury which resulted are of a kind that may occur even though reasonable care has been taken.

In the present case, the patient was admitted with diagnosis of acute cholecystitis. Laparoscopic cholecystectomy, which is the treatment of choice for gallbladder diseases[1] was performed by the treating surgeon. During the surgical procedure, injury to common bile duct occurred. Bile duct injuries result in high morbidity, long-term hospitalization and may be life threatening.[1] The incidence of bile duct injury reported varies in different studies. Gronroos et al (2003) reported that the risk of bile duct injury was 0.86% in total patient population.[2] Krahenbuhl, et al (2001) reported that overall bile duct injury incidence was 0.3%; 0.18% for symptomatic gallstones, and 0.36% for acute cholecystitis .In case of severe chronic cholecystitis with shrunken gallbladder incidence was as high as 3%.[5] Calvete et al (2000) reported that overall incidence of bile duct injury was 1.4%[6] and Huang , et al (1997) reported that bile duct injury accounted for 0.32%.[7]

Richardson, et al (1996) has mentioned that severe inflammation, aberrant anatomy and poor visualization as contributory factors for CBD injury.[8] This complication may occur even when the operating surgeon is well experienced.[5,6,9] Francoeur et al (2003) reported that these injuries could not be anticipated and as such it is an inherent risk of this procedure thus, it is unavoidable and uniformly first concerned of surgeon after injury is about the patients well being.[9]

The bile duct injury in this case was immediately recognized by the operating surgeon. Injury to common bile duct was repaired by using T-Tube and converting the procedure of laparoscopic cholecystectomy to open procedure. Other senior surgeon was also consulted and involved in operation. The procedure adopted was in conformation to that as reported in literature.[5,6] Kienzle (1999) had reported that bile duct injury cannot be considered as malpractice, because it could be intraoperatively made out and immediately treated.[10] Carroll et al (1998) concluded that factors that predisposes to lawsuits include treatment failures in immediately recognized injuries, complications that result from delays in diagnosis and misinterpretation of abnormal cholangiograms.[11] Low et al (1997) reported that in Germany the main reasons for acceptance of a case of common bile duct injury in laparoscopic cholecystetomy as malpractice were delay in changing to conventional cholecystectomy, delay revisions, laparoscopic revisions and not reverting to conventional cholecystectomy in unclear situations.[12]

Clinical record revealed that patient was appropriately managed postoperatively. He was admitted in intensive care unit. All the relevant investigations were carried out. The consultations were taken from the nephrologists and physicians of critical care units. In spite of all possible measures patient could not survive. As per report of postmortem examination, the cause of death was multiple organ failure due to septicemia following surgical procedure for gallbladder. Such events though rare, are known to occur and are reported in literature. Bauer, et al (1998) reported one case of bile duct injury during laparoscopic cholecystectomy, who died postoperatively due to multiorgan system failure.[13] There was/were no evidence/s or finding/s which could substantiate the allegation of negligence against the treating doctors. The literature supports the bile duct injury as an inherent risk of procedure.

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Laparoscopic Low Anterior Resection with Distal Rectal Washout Using the New Device of Gut-clamper

[1]Takao Ichihara, [2,3]Moriatsu Takada, [4]Yoshikazu Kuroda

[1]Department of Surgery, Nishinomiya Municipal Central Hospital, Nishinomiya, Hyogo, Japan
[2]Kobe Research Institute for Medical Sciences, Kobe, Japan
[3]Takada Medical and Surgical Clinic, Kobe, Japan
[4]Department of Gastroenterological Surgery, Graduate School of Medicine, Kobe University, Kobe, Japan

Correspondence: Moriatsu Takada, 2-1-4, Minamigoyo, Kita-ku, Kobe 651-1132, Japan
Tel: +81-78-904-8500; Fax: +81-78-904-8518; E-mail: moriatsu@kobe-u.com

Abstract

Background: Intraoperative rectal washout is considered to be important in colorectal surgery, but it is rather difficult in laparoscopic surgery. To resolve the problem, a new device called gut-clamper have invented for complete washout of the rectum during the laparoscopic low anterior resection.

Methods: Forty patients with rectal cancer underwent laparoscopic low anterior resection by a single skilled operator.

Results: Thirty patients with rectal cancer underwent laparoscopic low anterior resection with colorectal washout using gut-clamper. There was one complication of leakage in ten cases underwent without using gut-clamper. The number of times using laparoscopic staplers was 1.9±1.0 in the cases using gut-clamper, while that was 3.4 ± 1.1 in the cases without using gut-clamper.

Conclusion: This device of gut-clamper is easy and safe as well as reasonable physically and economically for intra-operative rectal washout including laparoscopic colorectal resection.

Keywords: Laparoscopic low anterior resection; rectal washout; gut-clamper.

INTRODUCTION

Intraoperative rectal washout is considered to be important in colorectal surgery, because implantation of exfoliated malignant cells is suggested as a possible mechanism of tumor recurrence in colorectal anastomosis that might be prevented by cytocidal washout. It is widely believed that the practice of distal rectal washout before anastomosis prevents implantation of free malignant cells followed by reducing the incidence of local recurrence.[1-3]

Standard guidelines are published regarding the effectiveness of preoperative colorectal washout. Preoperative mechanical bowel preparation is the common practice, despite lack of clear evidence of benefit from meta-analysis and randomized controlled trials to support its use.[4-8] Although some authors have recommended no preparation, an empty colon is generally considered to facilitate manipulation of the bowel during laparoscopic colon and rectal surgery. It has been reported that occlusion of the rectum allow for distal rectal washout.[9] It eliminates clamp slippage and faecal spillage and improves access to the distal rectum for low anastomosis.

When considering a completely laparoscopic approach with intracorporeal anastomosis, a complete reduction of the risk of postoperative leakage might be a major issue for the laparoscopic surgeons.

In colorectal surgery, it is required a sufficient space necessary for using instruments. Besides, it is rather difficult to secure the space in laparoscopic surgery. Under such circumstances, only a few laparoscopic surgeons have been performed intra-operative distal rectal washout.

In order to resolve the problem, we have invented a new device called gut-clamper for easy and complete washout of the rectum in the laparoscopic low anterior resection. Here, we describe the new technique using this device and discuss its clinical outcomes.

PATIENTS AND METHODS

Patients

From April 2004 through December 2007, thirty patients (13 men and 17 women) with rectal cancer underwent laparoscopic low anterior resection in Nishinomiya Municipal Central Hospital, Kobe University Hospital and it affiliates by a single skilled operator. Median patients age was 71.4 years (range 66-87). To investigate the effectiveness of gut-clamper, the patients with rectal cancer underwent laparoscopic low anterior resection with colorectal washout, with or without using gut-clamper.

GUT-CLAMPER AND SURGICAL PROCEDURE

Gut-clamper is a 5 mm width, plastic belt of 20 cm long that includes two hard sticks made of stainless steel with a diameter of 3 mm and 40 mm and 45 mm having flexible belts on one ends, a joint at which sticks are joined. At least one through hole made in one of the belts, and clips the rectum by using the two sticks by using the joint as a pivot (Fig. 1). By clipping the rectum by side surfaces of the sticks, it can be clipped while the width of the rectum is pressed and widened, so that the rectum is prevented from being excessively clamped and torn. The difference of length of the two steel sticks makes the good effect. As the two steel sticks are arranged tandem, their gaps is set in the middle of the plastic belt. A distance between these two sticks is 5 mm and the two steel sticks are hooked using the hole (3 mm in diameter) by bending with V-shape at this point (Fig. 2). If it failed to determine the point of clamping, one can untie the gut-clamper by pulling the belt of the hole. Distal rectal washout was carried out with 3 liters of water before dissection of the rectum with or without using gut-clamper. All other surgical procedures were performed after the manner of standard laparoscopic low anterior resection of the rectum.

RESULTS

Thirty patients (13 men and 17 women) with rectal cancer underwent laparoscopic low anterior resection with colorectal washout using gut-clamper (Fig. 3). Ten cases (5 men and 5 women) underwent colorectal washout without using gut-clamper (Table 1).

Although there were no complications in the thirty cases with distal rectal washout using gut-clamper, there was one complication of leakage in the ten cases of distal rectal washout without using gut-clamper. Among these, four cases were impossible to complete the distal rectal washout because it was difficult to hold the forceps and tube for washout.

The number of times using laparoscopic staplers (linear cutter) was 1.9 ± 1.0 in the cases using gut-clamper, while that was 3.4 ± 1.1 in the cases underwent colorectal washout without using gut-clamper. No cases showed relapses of gut-clamper and there was no postoperative death in all cases.

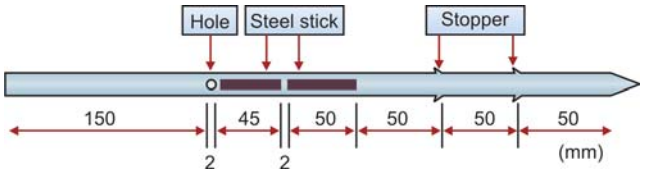

Fig. 1: *Structure of gut-clamper:* Gut-clamper is a 5 mm width, plastic belt of 20 cm long that includes two hard sticks made of stainless steel with a diameter of 3 mm and 40 mm and 45 mm having flexible belts on one ends, a joint at which sticks are joined

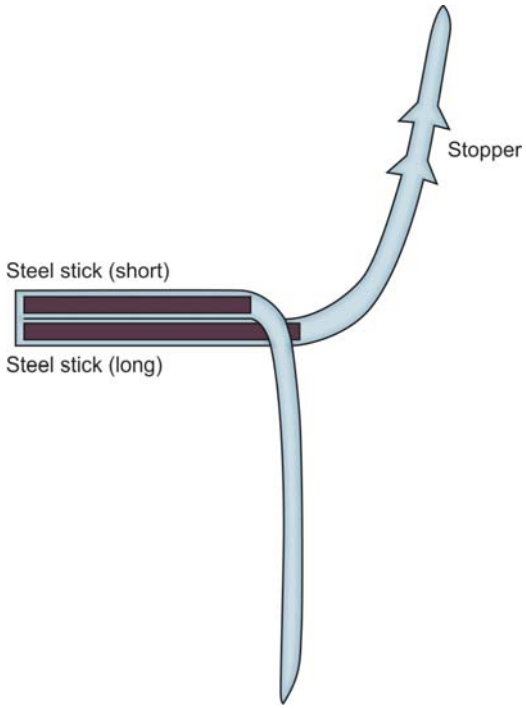

Fig. 2: *Schema of clamping using gut-clamper:* As the two steel sticks are arranged tandem, their gaps is set in the middle of the plastic belt. A distance between these two sticks is 5 mm and the two steel sticks are hooked using the hole (3 mm in diameter) by bending with V-shape at this point

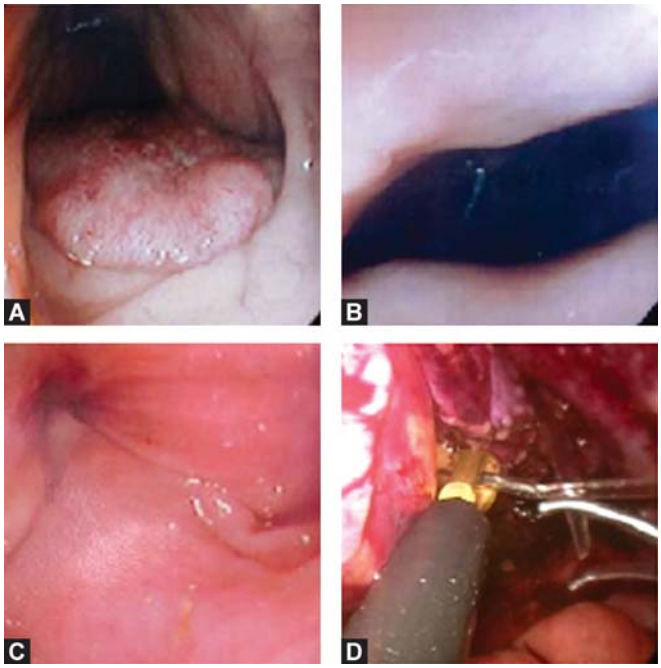

Fig. 3: *Intraoperative view after distal rectal washout using gut-clamper:* Confirming the location of the tumor, the gut-clamper was closed after distal rectal washout. Endoscopic view of rectum before closing (A), during closing (B), after closing (C) and laparoscopic view of distal rectal washout using gut-clamper (D)

TABLE 1: Advantages of gut-clamper and characteristics of the patients

	With gut-clamper	*Without gut-clamper*
Number of the cases	30	10
Age range	66-87	65-92
Mean	71.4	70.2
Sex male: female	13:17	5:5
Rate of complete washout	100	60
The number of times using stapler	1.9±1.0	3.4±1.1
Complication	none	leakage (one case)

DISCUSSION

Studies have shown that viable tumor cells exist in the lumen of the colon and rectum. Therefore, it is believed that rectal washout might have value. Nevertheless, no data conclusively demonstrate reduction of local recurrence or anastomotic implantation with rectal washout.[1] There are reported that exfoliated malignant cells have been found in the effluent of resection margins in the rectal stumps and on circular stapling devices.[10-12] In addition, the viability and metastatic potential of exfoliated malignant colorectal cells have been implicated.[11,12] As the evidence for potential anastomotic implantation, with no risk and minimal cost, it might have some utility in the management of rectal cancer, where the proximity of the anastomotic site and the cancer is close. Beside, it might reduce the microbial concentration that is associated to the leakage of anastomotic site.

In laparoscopic surgery, it is sometimes difficult to apply the same technique as the open surgery. After the first laparoscopic colectomy, a lot of laparoscopic surgical innovations for colorectal cancer have been made.[13-17] Nevertheless, there was no established method for perioperative rectal washout before the resection of the rectum in laparoscopic low anterior resection.

Here, we have introduced gut-clamper including, two hard steel stick having belts with flexibility on their one ends, a joint at which the steel sticks are joined, and one through hole made in one of the belts. As the belts with flexibility are made of a soft resin, it can be safely wound around the gut tract like a band.

The gut-clamper clips the gut tract by using the two hard steel sticks by using the joint as a pivot. Different from the case where the gut tract is tightened in a ringed manner with a string or silk thread, this clipping method has the following advantages.

When clipping, the side surfaces of the steel stick clip the gut tract, therefore, the gut tract can be clipped while the width of the gut tract is pressed and widened, so that tearing of the gut due to excessive tightening as in the case of tightening in a ringed manner does not occur.

Different from ringed manner, as it were, this linear manner of clipping using gut-clamper makes possible to reduce the number of times using laparoscopic staplers as shown in our results. As the laparoscopic staplers are easy for the liberalized gut tract, this gut-clamper is very suitable to use in laparoscopic surgery.

Moreover, when tightening the gut tract in a ringed manner, the tightened portion is constricted like a banded bundle. When observing the gut tract from the interior of the gut tract through a scope, it becomes difficult to accurately identify the resection line due to the constricted portion, therefore, extra portions may be resected in the gut tract resection. However, in the case of the gut-clamper, especially in laparoscopic low anterior resection, the gut tract is clipped by the steel sticks and the width of the gut tract is pressed and widened, and the constricted portion is reduced, so that rational resection of the gut tract could be made after the rectal washout.

Distal rectal washout has been recommended to prevent implantation of exfoliated malignant cells in the after anterior resection for rectal cancer.[18] Maeda et al have been reported that the irrigation volume determined the efficacy of rectal washout were 1.5 liters of saline irrigation appears to clear contents from cancer cells in patients with tumors below the peritoneal reflection whereas at least 2 liters is recommended for patients with tumor above the peritoneal reflection. As for laparoscopic low anterior resection, we have used much more volume for irrigation (3 liters of water). Nevertheless, only 60% were completed in the cases underwent colorectal washout without using gut-clamper, but 100% were possible to perform distal rectal washout using gut-clamper. Our data of the reduced rate of complete washout also support the benefit of gut-clamper for the proper sealing the gut tract.

Furthermore, the gut-clamper wherein lengths of the two steel sticks are made different from each other and the position of a hole made in a belt connected to the shorter steel stick, is set to match with the end of the longer steel stick when the two sticks are put together by using the joint as a pivot. This mechanism is easy and safe as well as reasonable physically and economically. This device of gut-clamper enables to shed novel lights on the new standard method for rectal cancer.

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Laparoscopic Repair of Ventral Hernia an Early Experience at Khyber Teaching Hospital, Peshawar

[1]Rooh-ul-Muqim, [2]Qutb-E-Alam Jan, [3]Mohammad Zarin, [4]Muhammad Taimoor Khan, [5]Javeria Iqbal
[6]Iftikhar Mohammad Khan, [7]Mehmud Aurangzeb, [8]Aziz Wazir

[1]Associate Professor, Surgical-D Unit, KTH, Peshawar, Pakistan
[2]Assistant Professor, Surgical-A Unit, KTH, Peshawar, Pakistan
[3]Assistant Professor, Surgical-D Unit, KTH, Peshawar, Pakistan
[4]House Surgeon, Surgical-D Unit, KTH, Peshawar, Pakistan
[5]Trainee Medical Officer, Surgical-D Unit, KTH, Peshawar, Pakistan
[6]Trainee Medical Officer, Surgical-E Unit, KTH, Peshawar, Pakistan
[7]Surgical-E Unit, KTH, Peshawar, Pakistan
[8]Surgical-D Unit, KTH, Peshawar, Pakistan

Correspondence: Rooh-ul-Muqim, H. No.185, St. No. 5, Sector J-2, Phase II, Hayatabad, Peshawar, Pakistan

Abstract

Objective: To analyze the results and outcome of laparoscopic ventral hernia repair as a relatively new technique in our setup.

Design and duration: Prospective study from June 2007 to June 2008.

Setting: Surgical-D Unit, Khyber Teaching Hospital, Peshawar.

Patients: All the patients undergoing laparoscopic ventral hernia repair.

Methodology: The patients were evaluated clinically and by investigations. After appropriate preparation, laparoscopic mesh repair was performed. Intra- and postoperative complications, and the outcomes were noted and the whole data analyzed.

Results: Out of the total 54 cases, 7 (12.96%) were umbilical hernia, 13 (24.07%) paraumbilical, 9 (16.66%) epigastric and 25 (46.29%) were incisional hernia. All patients had mesh repaired, the operating time ranged from 35 minutes to 2 hours in difficult cases with adhesions. All cases were successfully carried out laparoscopically. The complication rate was low with only 3 patients having port-site bleeding, 9 (16.66%) omental bleeding, 2 (3.7%) seroma, 3 (5.55%) had superficial infection. Severe pain in 11 (20.37%) requiring injectable analgesics and only 1 (1.85%) patient had recurrence at 4 months. No mortality and major complication were reported with excellent patient and surgeon satisfaction.

Conclusion: LVHR is a safe procedure with shorter operating time, few complications, short hospital stay, less recurrence and better patient satisfaction.

Keywords: Ventral hernia; laparoscopic repair; outcome; complications.

INTRODUCTION

Ventral hernias result from a weakness or loss of structural integrity, of the musculoaponeurotic layer of the anterior abdominal wall. Primary ventral hernias occurs spontaneously due to primary fascial pathology, and include umbilical, epigastric, spigelian, lumbar and other hernias.[1] Postoperative ventral hernia or incisional hernia is a common complication following abdominal surgery and is a significant cause of morbidity.[2] An incisional hernia develops in 3-13% of laparotomy incisions.[3]

Repair of ventral hernia may be difficult, and a wide range of surgical procedure have been developed for it. Tension-free repair is one of the key concepts in hernia surgery. The repair may be direct suturing or use of prosthetic mesh using the open or laparoscopic technique. Prosthetic mesh and tension free repair has revolutionized the repair of ventral hernias resulting in decrease in recurrence rates.[4]

Laparoscopic repair of ventral hernias is rapidly becoming more common, its utility, cost-effectiveness, lower infection and recurrence rates make it a very attractive option.[5,6]

We receive a number of patients with primary and incisional ventral hernias, sometimes recurrent hernias, from different parts of the province. Laparoscopic repair of ventral hernias has been recently started in our setup. This study was aimed to analyze the outcome of laparoscopic repair of ventral hernias using a prosthetic mesh as a relatively new technique in our setup.

MATERIALS AND METHODS

This study was conducted in the surgical-D unit of Khyber Teaching Hospital, Peshawar from June 2007 to June 2008. All patients presenting with ventral hernia were included in the study. Patients with respiratory and cardiac compromise unfit for laparoscopy and anesthesia were excluded.

Patients were evaluated by a detailed history including history of previous surgery, medical disease. Detailed physical examination was done to demarcate the extent and location of

hernia and to rule out any strangulation, etc. Routine base line investigations like full blood count, blood glucose level, urinalysis and hepatitis screen were done in all patients. An abdominal ultrasonography was done to the exclude any other pathology like gallstones or any other intra-abdominal pathology. The patient was counseled regarding the procedure and a written consent was obtained. The laparoscopic mesh repair was performed under general anesthesia. The patient was positioned according to the site of hernia.

TECHNIQUE

Two or three and sometimes four ports were used depending on the hernia, using base ball diamond concept. Adhesiolysis was performed and contents of the sac were released and reduced. The defect was identified and proline mesh was measured on the defect from the outside. Sutures were applied at three corners of the mesh using vicryl 1or 0 suture, and both the ends of the suture were left long and cut at 6-10 cm length and needle removed. Skin stab nicks were made at four quadrants of the hernia defect site, for passing a suture passer. Now through one of the skin nicks one end of another vicryl suture was passed into the abdominal cavity with the help of a suture passer and its end pulled into the abdominal cavity and then again brought out though the lateral part and then secured to the forth corner of the mesh. The end was left long and the needle cut. The mesh was pulled in the cavity through this part, by pulling on the last vicryl already passed in the skin. The mesh was fixed over the defect. The long ends of the vicryl stitches attached on 4 corners of the mesh were brought out through the skin holes with the help of suture passer and they were tied outside securing the mesh to the abdominal wall. Sometimes in large defects another suture was placed in the center of mesh for better fixation. The omentum was then brought down under the mesh. The ports are removed after deflating the gas and port sites stitched. The total time taken by the procedure ranged from 35 minutes to 2 hours. Post operatively the patients were given systemic antibiotic for 24 hours. The need for pain relief was minimum. Patients were mobilized in the evening and were allowed oral sips. They were discharged on the first or second day on oral antibiotics and analgesics given if were needed. Follow up was done at 2 weeks and then at 6 weeks for any late complications. This procedure is practiced in Laparoscopy Hospital , Tilak Nagar, New Delhi, India by renowned Laparoscopic Surgeon Dr RK Mishra.

RESULTS

Fifty-four patients underwent laparoscopic ventral hernia repair during the study period. 38 were female and 16 were males. The ages ranged from 25-62 years with only 3 patients above 50 years of age. Majority of the patients had incisional hernia forming 46.29% of all patients as shown in Table 1. 13 (24.07%) patients had paraumbilical hernia, 9 (16.66%) had epigastric and 7 (12.96%) had umbilical hernia. Umbilical and paraumbilical hernias were small ranging from 2-5 cm defect. The incisional hernia ranged from 5-10 cm while in only 2 (3.20%) patients defects was greater than 10 cm in size (Table 2). Incisional hernias of the upper middle and lower middle scars were 5 (9.25%) each while 6 (11.11%) occurred after suprapubic (pfaunenstiel) incision.

Only 2 ports for laparoscopic repair were used in 22 patients, in 19 patients 3 ports were used whereas in 3 patients with big hernias a 4th port was also introduced. In all patients proline mesh was used. In all patients the procedure was successfully completed laparoscopically. No additional procedure were carried out during herniorrhaphy. Intraoperative blood loss was negligible. The duration of operation was 35 minutes to 2 hours. The postoperative stay in hospital ranged from 1-3 days (Table 3).

TABLE 1: Types of hernia (n = 54)

Type of hernia	*No. of patients*	*%age*
Umbilical	7	12.9
Paraumbilical	13	24.07
Epigastric	9	16.66
Incisional	25	46.29
• Upper midline	5	9.25
• Lower midline	5	9.25
• Pfannenstiel	6	11.11
• Subcostal	4	7.40
• Grid iron	4	7.40
• Transverse midline	1	1.85

TABLE 2: Size of hernial defect (n = 54)

Size in cm	*No. of Patients*	*%age*
2–5 cm	33	61.11
6–10 cm	19	35.18
>10 cm	2	3.70

TABLE 3: Complications and outcome

Complications	*No. of patients*	*%age*
Port site bleeding	3	5.55
Omental bleeding	9	16.66
Pain		
• severe	11	20.37
• moderate	22	40.74
• mild	18	33.33
Port site infection	3	5.55
Seroma	2	3.70
Reoccurrence	1	1.85
Conversion	0	—
Mortality	0	—

In our series complication rate was low. There was no mortality or major complication. 3 patients had port site bleeding which was controlled by taking a simple suture. 9 (16.66%) patients had omental bleeding, which was controlled with diathermy. Severe pain was complained postoperatively by only 11 (20.37%) patients requiring multiple analgesic injections while in the rest mild to moderate pain was relieved after a single analgesic injection. 2 (3.7%) patients developed a seroma that subsided with conservative treatment in 2 weeks while another 3 (5.55%) had superficial port site infection. This responded to daily dressing and cleaning with antibiotic treatment. During follow-up period, there was a single recurrence at 4 months, giving a rate of 1.85%. The overall outcome with patient and surgeon satisfaction was excellent.

DISCUSSION

Ventral abdominal hernias represent a frequent and often formidable clinical problem, and a lasting surgical correction remains a challenge. Laparoscopic ventral hernia repair (LVHR) is becoming a popular technique with good results and a fast postoperative recovery. The mesh is placed directly under the peritoneum and anchored with transabdominal sutures and tacks.[7]

The LVHR utilizes the principles of the open technique, including using a large mesh prosthesis, adequate overlap of the hernia defect and eliminating tension. The mesh is placed intraperitoneally and extensive soft tissue dissection is eliminated.[8] Various comparative studies have shown that with LVHR, wound complication rate, patient discomfort, length of hospital stay, time to return to normal activities and recurrence rates are all reduced.[2,9,10]

Our study group included 54 patients with ages ranging between 25-62 years whereas other studies have reported mean ages of 55.25 years and 56 years.[2,9] Incisional hernias were the commonest ventral hernias followed by paraumbilical hernias in our patients. Other studies also show postoperative ventral hernias as a common occurrence and a significant cause of morbidity and a common indication for laparoscopic repair.[1, 9, 11]

In our series, the patient as a group had a good outcome. Despite an early experience with this technique there were no conversion to open surgery. The operating time ranged between 35 minutes to 2 hours in difficult cases due to adhesions and obesity. Others have reported mean operating time as 90.6 minutes and 117 minutes, whereas in one series average time taken was 65.6 minutes (range 28-130 minutes).[2, 8, 9] Open mesh repair also required longer operating time and associated with greater blood loss than simple repair.[12]

There were no major intraoperative accidents and also no mortality or major complication in our series. Omental bleeding occurred in 9 (16.66%) and port site bleeding occurred in 3 (5.55%) patients, it was controlled with diathermy laparoscopically. Other series also have reported fewer complications, commonly a seroma in 2-4.4%, pain in 2.5% and sepsis in only 0.25% patients.[9, 10, 13] We had seroma in only 2 (3.7%) patients and they were treated conservatively.

The suture site pain was common and severe pain was complained by 11 (20.31%), and moderate pain by 22 (40.74%) patients. Suture site pain may have originated from tissue or nerve entrapment during placement of sutures through full thickness of anterior abdominal wall. It could also result from traction of transabdominal sutures fixing the mesh to the anterior abdominal wall. However fixing is vital to the long-term durability of mesh repair and do not advocate any change in technique. Suture site pain was managed by analgesics and improved with time. The other major complications following LVHR, like enterotomy, mesh infection, skin breakdown, intra-abdominal abscess have been documented, but we did not encounter such complications. There was only 1 (1.85%) recurrence at 4 months in our series, however other have reported a recurrence rate of 4% and 2.5% between 1-3 months of surgery.[4, 9] Cobb WS et al reported recurrence as 4.7% after a mean follow up period of 21 months.[14]

Mobilization, hospital discharge and return to activities were prompt, with an average hospital stay of 2 days in our patients, and majority of them returned to work after 2 weeks. Mean hospital stay in LVHR has been reported as 2.4 and 3 days.[10, 14] Navitsky YW, et al has described LVHR as an approach of choice in obese patients with no perioperative mortality, mean hospital stay of 2.6 days and a recurrence rate of 5.5% at 25 months follow-up.[15] LVHR can be extended to any patient who is a candidate for open repair and with an acceptable risk for general anesthesia.[8] As experience increases LVHR can safely be done in patients with multiple prior abdominal procedures and in atypically located hernias. The limitations in our study are the relatively small study group and the short mean follow up period. This paper serves to show our experience for better awareness and acceptability of the procedure.

CONCLUSION

Although LVHR may be challenging, it has the potential to be considered a primary approach for most ventral and incisional hernias, regardless of patient status or hernia complexity. LVHR in our experience was safe and resulted in shorter operative time, fewer complications, shorter hospital stays, and less recurrence. It should be considered as the procedure of choice for ventral hernia repair.

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The Role of Laparoscopic Uterine Nerve Ablation (LUNA) and Presacral Neurectomy (PSN) of Pelvic Pain Management

Ashon Sa'adi

Gynecological Specialist and Laparoscopic Surgeon, Department of Obstetrics and Gynecology, Dr Soetomo Hospital of Surabaya, Indonesia

Abstract

Background: The chronic pelvic pain as non-cyclical pain is serious enough to cause disability or lead to medical care. While these treatments are very successful there is still a 20 to 25% failure rate and surgery has been an option for such cases. Effectiveness of laparoscopic uterosacral nerve ablation (LUNA) and presacral neurectomy (PSN) can be useful for alleviating chronic pelvic pain.

Objectives: To assess the effectiveness of surgical interruption of pelvic nerve pathways in primary and secondary dysmenorrheal in the chonic pelvic pain.

Data sources: Various watchfulness sources related to surgically chronic pelvic pain treatment from various causes and journals, also involve the Cochrane Menstrual Disorders and Subfertility Group Trials Register (9 June 2004), CENTRAL (The Cochrane Library, Issue 2, 2004), MEDLINE (1966 to Nov. 2003), EMBASE (1980 to Nov. 2003), CINAHL (1982 to Oct. 2003), MetaRegister of Controlled Trials, the citation lists of review articles and included trials.

Methods: Review and analyzed of prospective study of laparoscopy presacral neurectomy / PSN or laparoscopy uterosacral nerve ablation / LUNA (both open and laparoscopic procedures) for the treatment of pelvic pain (primary and secondary dysmenorrheal). The main outcome measures were pain relief and adverse effects.

Results: We have got 13 sources analysis extracted data on characteristics of the study quality and the population, intervention, and outcome independently. Nine randomized controlled trials were included in the systematic review. There were two trials with open presacral neurectomy; all other trials used laparoscopic techniques. For the treatment of primary dysmenorrhea, laparoscopic uterosacral nerve ablation at 12 months was better when compared to a control or no treatment. The comparison of laparoscopic uterosacral nerve ablation with presacral neurectomy for primary dysmenorrhea showed that at 12 months follow-up, presacral neurectomy was more effective. In secondary dysmenorrhea, along with laparoscopic surgical treatment of endometriosis, the addition of laparoscopic uterosacral nerve ablation did not improve the pain relief, while comparing to presacral neurectomy. Side effects were more common for presacral neurectomy than procedures laparoscopy uterine nerve ablation.

Conclusion: Currently, we have showed that LUNA and PSN can be an option in primary or secondary menstrual pain without endometriosis; LUNA has not been shown to reduce dysmenorrhea and, therefore, should not be advocated as a mainstream treatment except who have persistent dysmenorrhea.

Keywords: Chronic pelvic pain; laparoscopy uterine nerve ablation; presacral neurectomy; dysmenorrheal.

INTRODUCTION

The chronic pelvic pains of more than a year's duration have been suffering of approximately 15-20 % of women between 18 and 50 years of age. Survey in Europe has showed prevalence of dysmenorrhoea (12 studies) is 59% (95% CI 49.1-71%), of dyspareunia (11 studies) is 13.3% (95% CI 8.8-20.3%) and of noncyclical pain (2 studies) is 6.2% (95% CI 3-12.6%).[1,2] CPP refers to menstrual or nonmenstrual pain of at least six months' duration occurring below the umbilicus. Pain syndromes are caused by activation of nociceptors and transmission of signals in pain pathways. Thus, they are expected to respond to interruption or modulation of that transmission at any level above the site of activation. Chronic pelvic pain includes primary and secondary dysmenorrhea.[3,4,5]

Endometriosis is the most common gynecological cause of chronic pelvic pain. Other causes of chronic pelvic pain include pelvic inflammatory disease, psychologically stress, pelvic congestion syndrome, nerve entrapment related to muscular spasm, interstitial cystitis, and pelvic floor pain. Treatment for chronic pelvic pain depends on the underlying cause, severity of symptoms, the extent and location of disease, the desire for pregnancy, and the age of the patient. Laparoscopic presacral neurectomy has been extensively studied and considered as an effective technique for the treatment of chronic pelvic pain and dysmenorrhea in selected cases. If conservative medical treatments fail to relieve symptoms, second-line pharmacologics, such as hormonal treatment, may be indicated, conservative surgery (LUNA or PSN) and hysterectomy may be considered for patients with severe symptoms that do not respond to conservative treatment (20-25% of failure rate). This precise

estimation of disease burden should be considered by policy makers when planning gynecological services.[6,7]

AIM/OBJECTIVES

The aim of this review is to analyse role and useful technique of laparoscopic *presacral neurolysis* (PSN) and *laparoscopic uterine nerve ablation* (LUNA) to report followed cases on symptom resolution. What LUNA and PSN still useful for pain treatment performance and it has dangerous side effects?

METHODS

A literature search was performed using Google, Yahoo, Springerlink and Highwire Press. The following search terms were used: *Laparoscopic uterine nerve ablation (LUNA) and Presacral Neurectomy (PSN), complications of LUNA* and *complication Presacral Neurectomy (PSN)* . The 13 number of quality citations reviewed was selected for this review. The criteria for selection were:

- At least 13 sources should be included in the study especially for evaluation.
- *Method of analysis:* Retrospective analysis RCT.
- *Type of operative:* Laparoscopic procedure
- The institution where the procedure was practiced (preference for those specialized for laparoscopic surgery).

OPERATIVE TECHNIQUE

Procedure Specific for Laparoscopicy Uterine Nerve Ablation and Presacral Neurectomy[8]

The use of nerve transection procedures has been investigated for the treatment of chronic pelvic pain. They are often carried out during the course of other surgical treatment for endometriosis. The most common of these nerve transection procedures are laparoscopic uterine nerve ablation (LUNA) and presacral neurectomy (PSN).

Laparoscopic Uterine Nerve Ablation (LUNA) Procedure

The goal is the interruption of uterine nerve fibers traveling down the ligament and relief of uterine pain. During a LUNA procedure, the uterosacral ligaments (USL) are transected near their insertion into the posterior cervix. Laparoscopic uterine nerve ablation involves the destruction of the uterine nerve fibers that exit the uterus through the uterosacral ligament. Recent anatomical studies by Fujii et al showed that the majority of uterosacral nerve fiber bundles were found at a distance of 6.5–33 mm and at a depth of 3–5 mm distal to the site of attachment of the uterosacral ligaments to the cervix. [9,10] (Fig. 1).

Presacral Neurectomy (PSN)

Laparoscopic electrosurgical PSN through an umbilical approach was developed in 1988. The technique and results have been described in detail. This technique was later adapted for use with a carbon dioxide laser.[11,12] The patient is placed in steep Trendelenburg position and rolled to the left, displacing the sigmoid laterally. A blunt probe also retracts the sigmoid laterally, effectively removing the sigmoid from the operative site. Presacral neurectomy is performed on the anterior aspects of vertebral bodies L5 and S1. The superior hypogastric plexus is the main pathway of neural transmission from the pelvis.

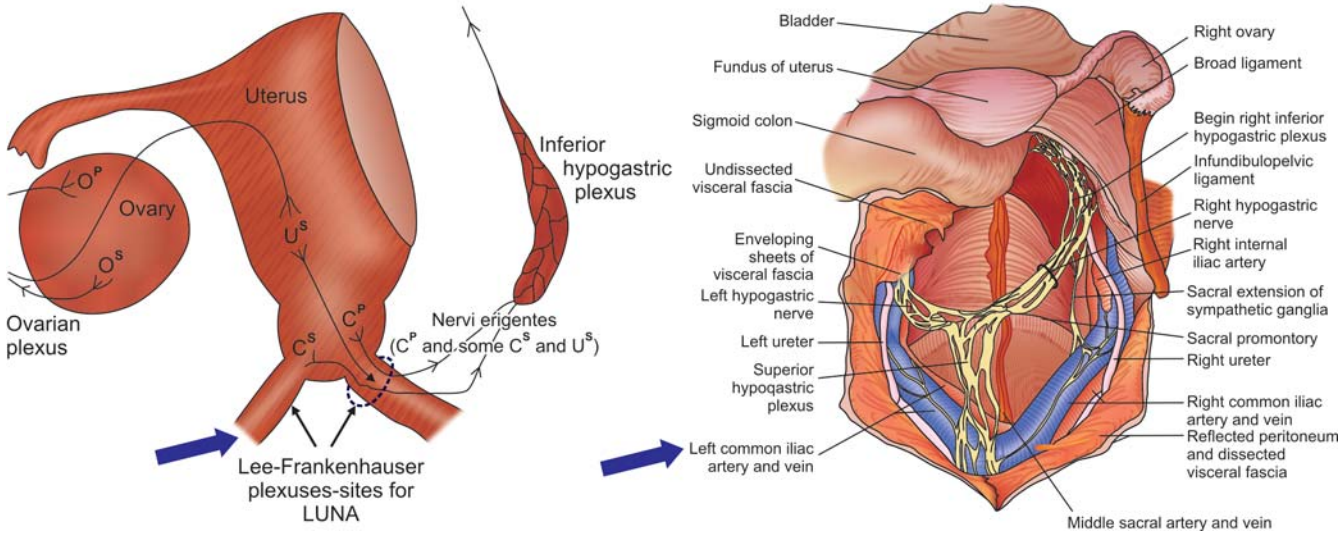

Fig. 1: Nerve slice position scheme of LUNA and PSN

While in neurectomy the plexus is exposed and the nerves are either cut or excised to interrupt the neural input, means the interruption of the sympathetic innervation of the uterus at the level of the superior hypogastric plexus (see Fig. 1).Adjacent vital structures which could be injured include the common iliac veins, the ureters, and the sigmoid mesentery. Presacral neurectomy is technically more challenging than LUNA because of the presence of large vessels and the ureters near the field of dissection.[13,14]

Variations in LUNA Methods

LUNA are the procedure interrupts/ablation of pelvic afferent sensory nerve fibers of the Lee-Frankenkauser nerve plexus. In a 1955 study of Doyle et al, vaginal transection of the nerves was effective for dysmenorrheal. Wide variations in the practice of LUNA have been shown by comparing the UK group with the rest of Europe. The latter were more likely to completely transect the uterosacral ligaments (56% vs 36%) at a distance 2 cm or more from its cervical insertion (50% vs 21%) than the UK group. Even the tools for ablation varied between these 2 groups, i.e. laser cutting (3% vs 32%), electrodiathermy (78% vs 75%), scissors cutting (22% vs 15%), and harmonic scalpel for cutting (8% vs 11%). There is widespread clinical uncertainty in the techniques, with insufficient evidence of effectiveness, thereby making it both harder to determine the optimal time, depth, and site of LUNA procedures, and the opinions regarding its use uncertain and variable.[15]

Effectiveness Measures of LUNA and PSN

A method structured survey was used to analyze gynecologists "prior beliefs" on the effectiveness for LUNA and PSN on pelvic pain by both numeric response (on a l0-point visual analog scale/VAS) and by responses to a questionnaire. The most widely held "prior belief" was that LUNA would have small beneficial effect on pain.[16] The secondary outcome measures will be assessment of sexual function and quality of life. The Sexual Activity Questionnaire (SAQ) will replace the Brief Index of Sexual Satisfaction (BISS) for the assessment sexual function.[17] Third measure is health-related quality of life (HRQL) instruments are becoming powerful tools for outcome assessments in randomised trials. Quality of life has to be defined clearly and patient's perception of normal performance serves a pivotal role in this context. HRQL instruments are administered with questionnaires assessing a number 1of different domains, i.e. areas of behavior or experience that the instrument is attempting to measure.[18]

Intraoperative and Postoperative Complications

The adverse events of PSN were significantly more common than those of LUNA. In general, LUNA is extremely safe except for a few complications reported in the literature. The bowel is usually not at risk during a LUNA procedure, unless partial or complete obliteration of the cul-de-sac due to endometriosis is present. In this condition, a LUNA procedure with bowel adherent to a USL is inappropriate. One complication of a LUNA procedure would be the risk of damage to the ureter laying lateral to the uterosacral ligament / USL. Regardless of the surgical energy being used, damage to the ureter could occur in at least three ways, each avoidable.

First Way

Damage occurring as a consequence of extending the LUNA incision too laterally. This complication can be avoided by strong anterior placement of the uterus with an intrauterine manipulator, which puts the USLs on stretch and helps define them better.

Second Way

Damage occurring as a consequence of bipolar or monopolar electrocoagulation for hemostasis. Pelvic vessels lie lateral to the USL. The thick-walled, pulsating uterine artery is usually easily visible through the peritoneum and usually lies anterolaterally to the location of a LUNA procedure. Irrigation or retroperitoneal hydroinjection may help protect the ureter during electrocoagulation of a bleeder by providing heat sink (a site for cooling of the thermal spread).

Third Way

Damage occurring during transection of a uterosacral ligament involved by invasive endometriosis which has resulted in retroperitoneal fibrosis around the ureter. The avoidance of this complication is simple: It is inappropriate to transect a USL invaded by significant nodular endometriosis because the nodular endometriosis can still transmit pain along unsevered proximal nerves. The proper therapy is resection of the involved portion of the USL, which accomplishes a LUNA procedure simultaneously.

LUNA usually should not be repeated for two reasons: (1) If it was properly performed and did not work the first time, there is no reason to think it would work a second time; (2) The crater left by previous transection gives a spurious impression that a wide USL is present, and this can lead the transection more lateral.

Laparoscopic presacral neurectomies have been performed in over 220 by the author, one patient required repeat laparoscopy to evaluate continuing postoperative pain. A small hematoma was found in the presacral space which was evacuated and the patient recovered uneventfully. There have been no cases of injury to the bowel, ureter or great vessels.[19] Long-term complications with PSN are uncommon. An

occasional patient will report alteration of the sensation of bladder fullness due to interruption of sympathetic fibers carrying bladder sensation. Some patients may report a decrease of vaginal lubrication with sexual arousal. Constipation is not a predictable consequence of presacral neurectomy since the parasympathetic fibers which stimulate evacuation of the rectosigmoid pass through the inferior hypogastric plexus (also termed the pelvic plexus) and are not interrupted by PSN. Chen FP, Soong YK,1997: There are 485 (74%) of 655 patients complained of constipation after laparoscopic presacral neurectomy, which was relieved easily by medication. There were 0.6% major complications that required further surgery, including injury of the right internal iliac artery and chylous ascites. And 0.5% cases had laceration of the middle sacral vein controlled during laparoscopy.[20] Chen FP, Soong YK, 1997 (Table 1). In patients undergoing laparoscopic PSN, follow-up observation has shown evidence of long-term efficacy, similar to that seen after laparotomy PSN.[21,22]

DISCUSSION

Comparisons between LUNA and PSN

In a randomized study, Tjaden, et al., 1990; Candiani, et al; 1992; Zullo, et al., 2003 have been published three randomized controlled trials using PSN along with other surgical treatment of endometriosis.[22,24,27] A randomized controlled trial comparing outcomes of PSN to LUNA has also been published Chen FP, et al 1996. The comparison between laparoscopic presacral neurectomy (LPSN) and LUNA for control of primary dysmenorrhea showed effectiveness of 87.9% and 82.9%, respectively, at the 3-month postoperative follow-up, whereas, long-term LPSN was shown to be more effective than LUNA (81.8% vs 51.4 % at the 12-month visit).[26] Another study showed that the efficacy of LUNA declined from 72% in the first year to 39% in the fourth year. [23] However, only PSN but not LUNA was beneficial for alleviating secondary dysmenorrheal associated with endometriosis in some randomized

RESULTS

TABLE 1: The randomized controlled trials using LUNA or PSN for surgical treatment of pain management have been published

Author	*Year*	*Patients*	*Result of research*	*Others*
Litchen E, et al[23]	1987	21	Decrease efficacy 4th year LUNA	LUNA 1st and 4th year
Tjaden, et al.[22]	1990	26	There is some evidence of the effective	LUNA vs control of no treatment
Candiani, et al.[24]	1992	71	No statistically significant differences RCT	More complication
Chapron C, et al[25]	1996	21	94% improvement of pain	LUNA deep endometriosis
Chen FP, Chang, et al.[26]	1996	68	PSN was better in 1 year	PSN and LUNA
Chen FP, Soong YK et al[20]	1997	655	Significant for 12th month RCT	PSN more complication
Zullo, et al.[27]	2003	141	More effective PSN, RCT	PSN and LUNA
Soysal ME, et al[28]	2003	15	Significant resolusi pain and sexual 3,6,12 months Prospective observational	Baseline and PSN
Vercellini, et al. [(29)]	2003	180	Recurrent dysmenorrhea was similar for both groups RCTL	LUNA for pain endometriosis
Johnson NP, et al.[30]	2004	123	Significant reduction of dysmenorrheal. No significant difference in non-menstrual pelvic pain, deep dyspareunia or dyschezia	LUNA and medicine RCT
Proctor, et al,[6]	2005	Data Collection and Meta-analysis: 7 RCTs	No significant symptom by LUNA-PNS Unuseful	Case : Primary dysmenorhea Endometriosis
Juang, et al[31]	2006	12	Increase in satisfactory rate 3th and decrease in 12th months prospective observational	LUNA for deep dyspareunia Pilot study
Latthe PM, et al[32]	2007	Data collection and Meta-analysis: 9 RCTs	LUNA still effective PSN more effective Not significant in endometriosis	LUNA vs No surgical LUNA vs PSN

studies.[30] For the treatment of primary dysmenorrhea there is some evidence of the effectiveness of uterine nerve ablation LUNA when compared to a control of no treatment. Long term PSN was shown to be significantly more effective. Neverthless, the comparison between presacral neurectomy (PSN) with LUNA for primary dysmenorrhea in the short term showed no significant difference in pain relief. Adverse events were significantly more common for presacral neurectomy, however, the majority were complications such as constipation, which may spontaneously improve.[6] Adverse events were more common for PSN than procedures without PSN (or 14.6; 95% CI 5-42.5).[32] In the primary dysmenorrhea showed no significant difference in pain relief of the comparison between LUNA and laparoscopic presacral neurectomy (LPSN) in the short term; however, long-term LPSN was shown to be significantly more effective than LUNA.[33]

LUNA for Chronic Pelvic Pain without Endometriosis

The preliminary randomized study using LUNA as an adjuvant therapy for treating patients with secondary dysmenorrheal caused by uterine myoma also showed the effect of LUNA in alleviating pain.[12] Another randomized study by Johnson et al included 123 patients with chronic pelvic pain. Both uncontrolled and randomized double-blind studies had claimed support for LUNA with either complete relief or substantial reduction in menstrual pain in the majority of patients.[30] In 56 patients with no laparoscopic evidence of endometriosis, there was significant reduction of dysmenorrheal, with a median change in VAS / visual analog scale from baseline – 4.8 versus – 0.8 ($p = 0.039$), or 42.1% versus 14.3% experiencing successful treatment ($p = 0.045$). However, there is no evidence that LUNA is beneficial for non-menstrual pelvic pain. In a recent meta-analysis of 5 randomized trials, the authors have approached a consensus on the effectiveness of LUNA for menstrual pain. Similar findings were reported by 4 other randomized trials.[23,26] Tjaden et al 1990 : The addition of PSN to standard surgical therapy by laparotomy enhanced pain relief for midline/central pain. However, only eight of 26 patients were randomized and the study was terminated before completion because of significant reduction in midline pain by the patients undergoing PSN.[22] Nine RCTs were included in the systematic review. There were two trials with open presacral neurectomy (PSN); all other trials used laparoscopic techniques. For the treatment of primary dysmenorrhea, laparoscopic uterosacral nerve ablation (LUNA) at 12 months was better when compared to a control or no treatment (Odds Ratio or OR 6.12; 95% confidence interval /CI 1.78-21.03). The comparison of LUNA with PSN for primary dysmenorrhea showed that at 12 months follow-up, PSN was more effective (OR 0.10; 95% CI 0.03-0.32).[32]

A recently published guidance on Laparoscopic Uterine Nerve Ablation (LUNA) for Chronic Pelvic Pain from the National Institute for Health and Clinical Excellence (NICE, 2007) concluded: "The evidence on laparoscopic uterine nerve ablation (LUNA) for chronic pelvic pain suggests that it is not efficacious and therefore should not be used." Like in the criteria for quality of evidence and classification of recommendations for LUNA is III-C (Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees that there is insufficient evidence to support the recommendation for use of a diagnostic test, treatment, or intervention).[7,34]

LUNA for other Cases

Johnson et al[30] revealed no beneficial effect for dyspareunia and dyschezia by double-blind randomized study of LUNA. Also, another Vercellini et al [29] randomized study showed that LUNA had no additional effect for improvements in health-related quality of life, psychiatric profile, and sexual satisfaction. On the contrary a pilot study was undertaken to evaluate the effect of laparoscopic uterosacral nerve ablation (LUNA) for treatment of primary deep dyspareunia between July 2002 and June 2003, overall, 8 (66.7%) patients in this trial were very satisfied or satisfied at the initial postoperative evaluation and 6 of them (50.0%) remained satisfied at the final evaluation at 12 months.[31]

LUNA for Endometriosis

In a randomized trial of 180 patients with symptomatic endometriosis, the addition of LUNA to conservative laparoscopic surgery for endometriosis did not reduce the medium- or long-term frequency and severity of recurrent dysmenorrheal.[29] Another randomized study of 67 patients with chronic pelvic pain and laparoscopic evidence of endometriosis found no significant difference in pain outcome.[30,35] For the treatment of secondary dysmenorrhea the identified RCTs addressed only endometriosis. The treatment of LUNA combined with surgical treatment of endometrial implants versus surgical treatment of endometriosis alone showed that the addition of LUNA did not aid pain relief, the mentioned equal to PSN combined with endometriosis treatment versus endometriosis treatment alone there was also no overall difference in pain relief, although the data suggest a significant difference in relief of midline abdominal pain. In secondary dysmenorrhea, along with laparoscopic surgical treatment of endometriosis, the addition of LUNA did not improve the pain relief (OR 0.77; 95% CI 0.43-1.39) while PSN did (OR 3.14; 95% CI 1.59-6.21).[32] A cochrane systematic evidence review of clinical trials on surgical interruption of pelvic nerve pathways for primary and secondary dysmenorrhea found there was only limited evidence to support the use of LUNA for primary dysmenorrhea. Guidelines on chronic pelvic pain from ACOG (2004) concluded. Adding uterine nerve ablation to

surgical treatment of endometriosis-associated pelvic pain or dysmenorrhea does not improve the outcome of surgical treatment. Although Chapron et al 1996 concluded LUNA/laparoscopic surgery is efficient for the treatment of patients presenting painful symptoms related to deep endometriotic implants located on the uterosacral ligaments. Patients who benefited from an improvement rated it excellent or satisfactory in over 80% of cases.[25] Soysal ME et al noted a significant reduction in total pelvic symptom score as compared from baseline with postoperative at the 3rd, 6th and 12th month ($P < 0.001$), also observed a significant improvement in Sabbatberg Sexual Rating Scale as compared with baseline mean (SD) of 30.9 (4.3). The mean difference (95% CI) of increase was 33.4 (30.3 ± 36.4), 33.2 (30.1 ± 36.2) and 33.2 (30.1 ± 36.3) from the baseline at the 3rd, 6th and 12th postoperative month that performed laparoscopic presacral chemical neurolysis with phenol in 15 patients with pelvic pain and minimal ± moderate endometriosis.[28]

The guidelines recommended the following: Presacral neurectomy may be considered for treatment of centrally located dysmenorrhea but has limited efficacy for chronic pelvic pain or pain that is not central in its location.[2] Ablation of endometriotic lesions plus laparoscopic uterine nerve ablation (LUNA) in minimal–moderate disease reduces endometriosis-associated pain at 6 months compared to diagnostic laparoscopy, the smallest effect is seen in patients with minimal disease. However, there is no evidence that LUNA is a necessary component, as LUNA by itself, has no effect on dysmenorrhea associated with endometriosis.[29,36]

CONCLUSION

We have now showed that LUNA and PSN can be an option in a few circumstances, especially in primary or secondary menstrual pain without endometriosis. Finally, LUNA has not been shown to reduce dysmenorrhea and, therefore, should not be advocated as a mainstream treatment except who have persistent dysmenorrhea despite medical therapy.

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Two Rare Cases of Intrahepatic Subcapsular Hematoma After Laparoscopic Cholecystectomy

Minaya Bravo, González AM, González E, Cardeñoso Payo P, Ortiz Aguilar M, Larrañaga E

La Princesa Hospital, Calle Diego de León, n 62. 28006, Madrid, Spain

Abstract

The appearance of subcapsular hematoma liver after a laparoscopic cholecystectomy is a complication few studied and few cases have been described in the literature. Some of them have been connected to administration of ketorolac during and after surgery, because of its anti-platelet activity. But other factors such as hemangioma or lacerations could play an important role as well. In addition, the presence of circulating heparin-like anticoagulant present in hematological diseases like leukemia, multiple myeloma or amyloidosis would increase the risk of bleeding. We present two cases of subcapsular hematoma liver after laparoscopic cholecystectomy, both of them were given ketorolac, and one of them had multiple myeloma.

Keywords: Laparoscopic cholecystectomy; subcapsular hematoma liver; complication; ketorolac.

INTRODUCTION

The appearance of subcapsular liver hematoma after a laparoscopic cholecystectomy (LC) is a complication few frequent and few studied. Some cases have been connected to ketorolac given during surgery and after surgery. Others described causes are: hemangiomas or small iatrogenic lesions that could be aggravated by administration of ketorolac. Coagulation dysfunction like circulating heparin like seen in hematological diseases is cause of bleeding after aggressive procedures.

We describe two cases of subcapsular liver hematoma after LC, both of them have been given intravenous ketorolac and one of them had multiple myeloma. We discuss the causes and treatment of it.

CASE 1

A 69 years old woman with medical history of multiple myeloma and Pott´s disease was admitted for elective laparoscopic cholecystectomy (LC). An ultrasound previous to surgery showed cholelithiasis without signs of cholecystitis. Blood tests were normal (hemoglobin 13.5 g/L and normal coagulation tests).

LC was performed using four trocars: Two 10 mm trocars and two 5 mm trocars. The dissection was accomplished without difficulty. Neither wounds nor lacerations were observed during surgery. The patient was administered 30 mg of intravenous ketorol at the end of the surgery and the three days following surgery, 30 mg each 8 hours. The postoperative period was a bit slow due to pyrexia and few gastrointestinal symptoms.

On the fifth day after surgery, the patient had right upper quadrant pain, nauseas and vomits. Blood test showed a light decrease of hemoglobin: 9.6 g/L. An ultrasound was made and no lesions were revealed.

After 24 hours, the patient showed hemodynamic instability, hypotension and tachycardia, and blood test: hemoglobin of 4.5g/L, and increase of liver enzymes: GOT 5782, GPT 367 and FA 146. A CT (Figs 1 and 2) revealed an intrahepatic subcapsular collection in V, VI and VII hepatic segments (16 × 5 cm). The patient was admitted in the ICU. An arteriography was performed but no signs of active bleeding were observed.

So, an exploratory laparotomy was made due to hemodynamic instability despite blood and plasma support. An important hematoma in the right lobe hepatic was observed; it was drained and packing, a hepatic biopsy was taken. Neither parenchymal injury of the gallbladder bed nor iatrogenic lesions were seen. After 48 hours, the packing was reviewed and no signs of bleeding were seen.

The patient recovered uneventfully. Control CT was performed 20 days after surgery and it revealed avascular areas in V, VI and VII hepatic segments. Rest of liver was normal.

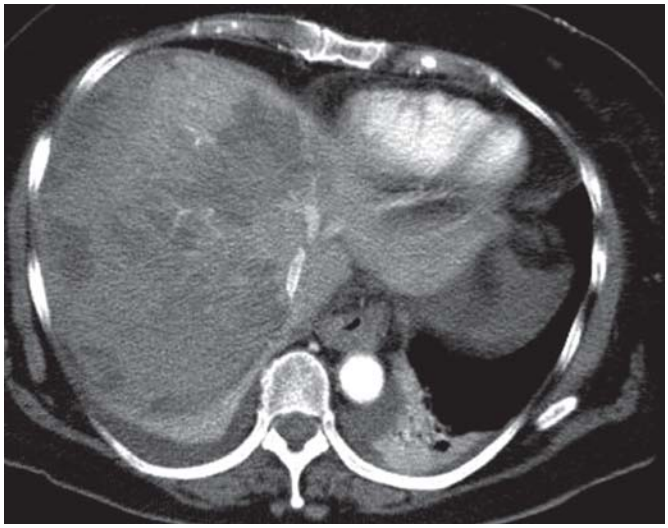

Fig. 1: Intrahepatic subcapsular collection in V, VI and VII hepatic segments

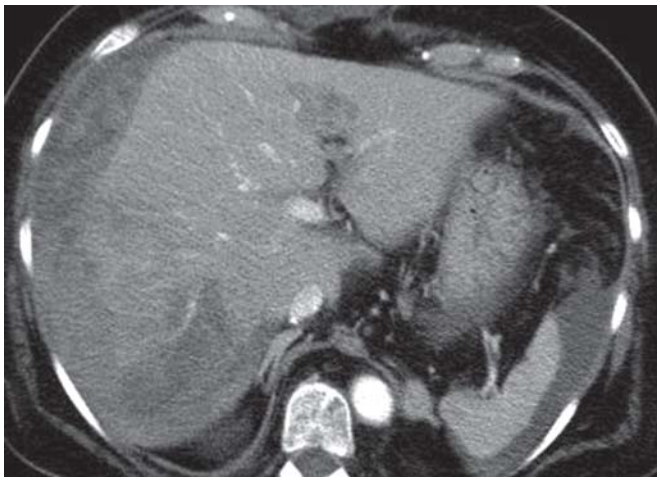

Fig. 2: Intrahepatic subcapsular collection in V, VI and VII hepatic segments (16 × 5 cm)

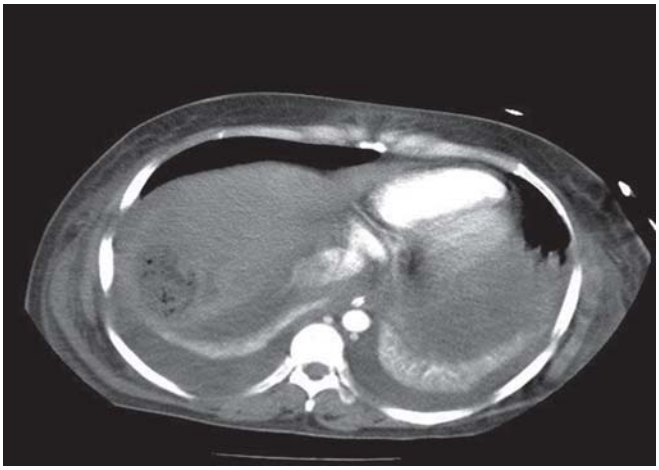

Fig. 3: Subcapsular hematoma in right lobe liver

She was also followed up by Hematology Department, and they suggested that the heparin like anticoagulant factor associated to hematology diseases (in this case multiple myeloma) could have triggered the bleeding and so, the subcapsular hematoma liver.

The patient was discharged 37 days after the elective LC.

The biopsy revealed ischemia and necrosis.

A new control CT was made after 5 months: Small hypocaptant areas in zone highest of right lobe liver, better than previous.

CASE 2

A 29 years old woman was admitted for elective LC because of cholelithiasis. Medical history was insignificant. Ultrasound previous to surgery revealed cholelithiasis without signs of cholecystitis. Blood tests were normal.

She underwent LC using four trocars: Two 10 mm trocars and two 5 mm trocars. The dissection of the gallbladder from the liver bed was accomplished easily. There were no incidents during surgery. She was administered ketorol 30 mg intravenous at the end of the surgery and each 8 hours after.

After 24 hours, the patient had an episode of perspiration and hypotension which did not improve with support measures. Blood test showed hemoglobin of 6 g/L and liver dysfunction. A CT was made and showed a subcapsular hematoma of the right lobe of liver (Fig. 3). So, she underwent exploratory laparotomy and we found a massive subcapsular hematoma of the right liver lobe. No iatrogenic lesions were found. The bed gallbladder did not present lesions. The hematoma was drained and we perfomed a packing. After 24 hours, we reviewed the patient and did not find signs of bleeding. A liver biopsy was taken and reported like hematic material.

After surgery the patient had pleural spillage, auricular fibrillation and polyneuropathy.

She was discharged after 30 days and is well and asymptomatic nowadays.

DISCUSSION

The LC is the choice for the treatment of symptomatic uncomplicated cholelithiasis.[9] The mortality rate is around 0.66%[9] and morbidity of 7%.[4] The appearance of postoperative hemorrhage is rare (0.08-0-2% of all cases),[2] and the places where more often occur are: Gallbladder bed, abdominal wall , cystic artery and falciform ligament.[2]

Ketorolac is the first injectable nonsteroidal anti-inflammatory drug used as an analgesic in the perioperative period,[1,3] it is also used by anestesists like part of the standardized, evidence-based regime.[11] Between all of the NSAIDs, ketorolac is associated with the highest risk estimate of bleeding.[10]

It has an antiplatelet activity and its activity could last as long as 24 hours after its administration.[3] Ketorolac could cause bleeding and hematoma, or aggravate any small hepatic injury during surgery.[1]

The presence of circulating heparin like anticoagulant is observed in hematological diseases such as multiple myeloma, T- prolymphocytic leukemia, so it has been described that these patients could bleed after small aggressive procedures[12] such as brown bone aspiration, cutaneous bleeding,[14] epistaxis[13] or deep site hematoma.[13]

So, there are several theories about the cause of subcapsular liver hematoma in these patients.

Traction of the lower hepatic surface made for irrigating and draining the subhepatic space would produce bleeding and hematoma , in addition to, hepatic hemangiomas were found in some cases, so the traction over the liver could break these hemangiomas, so this with administration of ketorolac would cause a liver subcapsular hematoma.[2] Some surgeons support the study of the hepatic parenchymal previous to surgery.

Three clear causes have been described like cause of liver hematoma: Small tears of the hepatic capsule after traction on the gallbladder, puncture of the liver with the trocar when introducing the trocar and parenchymal injury while excision of the gallbladder.[15]

Others back up that this kind of complication is inherent to the method of surgery itself.[5]

The diagnostic can be difficult till symptoms appear: Pain, fever, vomits or shock hypovolemic.

About the management: If the patient is stable, asymptomatic and the hematoma is small, a conservative therapy is the choice. But if the hematoma has an important size so it is likely that it can be reabsorbed, a percutaneous drain can be performed using under ultrasound guidance.[7] If the patient is unstable, a laparotomy is mandatory.[6]

We report about two cases:

The first one was a woman with multiple myeloma (IgA), who was given 30 mg intravenous ketorolac during and after surgery . There were no incidents during surgery and no lesions were seen. The postoperative recovery was slow with non-specific symptoms. She went under laparotomy because of hemodynamic instability. We did not find iatrogenic lesions, just an important hematoma in the right hepatic lobe. It was drained and a packing made.

The cause about this intrahepatic hematoma is not clear. We think that ketorolac could have had a role, or have aggravated some small lesions caused during surgery and not seen. In addition to, the patient had a multiple myeloma; the role of this is not clear because it was studied by hematologists and till now they have not been able to demonstrated alteration in coagulation tests. We think that more studies about this condition are needed because of some cases, in the literature, about bleeding in this patients. We cannot discard the breaking of some hemangioma during surgery though no hemangioma were seen in ultrasound previous to surgery.

In the second case, ketorolac was also administrated during and after surgery, 30 mg each 8 hours, intravenous. There were no incidents during surgery. Laparotomy was needed because of hemodynamic instability. But in this case, the cause seems to be a few more clear image of 2 cm of size compatible with a hemangioma was found in an ultrasound during the follow-up. We think that the hemangioma could have been broken fortuitously during surgery and not seen, and the ketorolac given would have aggravated the lesion, like Pietra et al. supports in his work.[2]

We conclude, the LC is a safe method and the choice for symptomatic uncomplicated cholelithiasis, with low mortality and morbidity. The presence of a subcapsular liver hematoma after a LC is a rare complication few studied. Till now only 10 cases have been reported. It has been connected to administration of ketorolac, which would aggravate small iatrogenic lesions occurring during surgery and that would go unnoticed. But other factors could have an important role, like the presence of hemangiomas that would be ruptured by chance during surgery or causes that would produce bleeding such as circulating heparin like associated to hematological disease such multiple myeloma or leukaemia. About the management: If the patient is stable the hematoma can be observed or drained percutanously with ultrasound guidance, and if instable laparotomy is mandatory.

More studies are needed to clear this causes and determinate is some kind of study should be accomplished in patient with risk of bleeding, as though the role of the ketorolac.

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Thoracic Epidural versus Morphine Patient Controlled Analgesia After Laparoscopic Colectomy

[1]RJ Dennis, [2]P Mills

[1]SpR General Surgery, Department of General Surgery, West Suffolk Hospital, Hardwick Lane, Bury St Edmunds, Suffolk IP33 2QZ
[2]Consultant anaesthetist, Department of Anesthetics, West Suffolk Hospital, Hardwick Lane, Bury St Edmunds, Suffolk IP33 2QZ

Correspondence: RJ Dennis, Department of General Surgery, Luton and Dunstable Hospital, Lewsey Road, Luton LU4 0DZ
E-mail: robertdennis@nhs.net

Abstract

Despite the benefits of the laparoscopic approach to colorectal surgery patients still experience significant levels of pain post- operatively. This study aimed to compare the use of thoracic epidural vs. morphine patient controlled analgesia in the management of pain after laparoscopic colorectal surgery. A retrospective analysis of hospital records was performed for 16 patients undergoing laparoscopic colorectal surgery (8 thoracic epidural, 8 patient controlled analgesia). Visual rating scale pain scores (0 – 10) were significantly lower for patients managed with thoracic epidural in recovery (mean [95% CI]) (0 vs. 5.3 [3.6-6.9]), at 6 hours (1 [0-2.0] vs. 5.4 [4.2-6.5]), 12 hours (0.4 [0-1.1] vs. 4.4 [3.3-5.4]) and 24 hours (1.3 [0-2.8] vs. 5.9 [4.9-6.9]). Thoracic epidural offers the optimal analgesia and quality of care to the patient following laparoscopic colectomy.

Keywords: Laparoscopic anesthesia; epidural versus morphine; laparoscopic colectomy; anethesia in colorectal surgery.

INTRODUCTION

Laparoscopic abdominal surgery avoids a large incision in the abdominal wall, thereby reducing both postoperative pain and the initiation of the postoperative inflammatory cascade response.[1] A number of studies including the COST trial have shown a reduction in analgesic requirements following laparoscopic colectomy compared with open colectomy.[2-4] Despite this reduction in analgesic requirements the intra-abdominal dissection and prolonged distension of the peritoneum and abdominal wall during laparoscopic colectomy, results in significant postoperative pain requiring provision of excellent analgesia to facilitate recovery.

In open surgery the two established techniques for postoperative pain management are thoracic epidural analgesia (TEA) and patient controlled analgesia (PCA) with intravenous morphine. TEA has been shown to provide superior pain relief when compared to PCA for up to 72 hours following open abdominal surgery.[5]

One previous American study by Senagore et al[6] demonstrated that pain control, measured as a secondary outcome, was significantly improved at 6 and 18 hours following laparoscopic surgery in patients receiving TEA compared to PCA. However the epidural opiate dosage was larger than those conventionally used in European practice and the TEA arm were allowed rescue analgesia with intravenous morphine boluses. One further study has shown improved analgesia in the first 48 hours after surgery with TEA using lower opiate dosages.[7]

This paper reports our experience of TEA vs PCA in the management of patients following laparoscopic colectomy.

METHODS

Patients

Sixteen patients who underwent laparoscopic colectomy (right hemicolectomy, sigmoid colectomy or subtotal colectomy) were included in this comparative study. The two groups of patients were those who received morphine PCA and those managed with TEA for postoperative pain control.

Mechanical bowel preparation was used in all cases, although limited to a single phosphate enema for right hemicolectomy. Prophylactic cefuroxime 0.75-1.5 gm and metronidazole 500 mg were administered intravenously at the induction of anesthesia. All patients had a catheter inserted at surgery and removed once sufficiently mobile and once the epidural catheter had been removed in the TEA group. All patients were permitted clear fluids immediately after surgery and a full diet introduced once any distention had settled and the patient had passed flatus. Patients were discharged from hospital when tolerating a normal diet and pain was well controlled on oral analgesics.

Anesthesia and Epidural Techniques

Preoperatively patients were visited by members of the acute pain service and received detailed oral and written information on the verbal rating pain scoring scheme and the method of postoperative analgesia that would be provided dependent on Consultant Anaesthetic preference. No patients received pre-medication.

Patients who had TEA all had the catheters placed at the mid-thoracic dermatomal level T7/8 or T8/9 prior to anesthesia. The epidural block was established with incremental doses of 0.25% L-Bupivacaine up to maximum dose of 15 ml. General anesthesia in both the TEA and PCA groups was induced with propofol (2-3 mg/kg) and fentanyl (1-2 mg/kg) and muscle relaxation achieved with rocuronium prior to intubation of the trachea and ventilation. Anesthesia was maintained with sevoflurane in an air/oxygen mixture. The PCA group received morphine intraoperatively up to a maximum dose of 15 mg. Both groups had intravenous paracetamol 1gm and this was continued postoperatively either orally or intravenously 6 hourly.

The patients with an epidural catheter were commenced immediately postoperatively on an infusion of 0.125% bupivacaine and 4mcg/ml of fentanyl at 8 mls/hour and this could be titrated up to 15 ml/hour to maintain adequate analgesia. Those with a PCA prescription had the handset connected in recovery and a standard prescription of 1mg bolus of morphine with a 5 minute lockout. Opiates via any other route were not administered to any patient.

All the patients were evaluated daily by the acute pain service and the epidural infusion and PCA analgesia continued until they were able to tolerate oral analgesia.

In the postoperative period pain was assessed using the verbal rating score from 0-10. Maximum pain at both rest and on movement was evaluated in the recovery unit at one hour following surgery and at 6, 12, 24 and 48 hours postoperatively.

Postoperative nausea that required treatment was managed in all patients with a standardized anti-emetic protocol consisting of cyclizine as first line therapy and subsequently ondansetron and dexamethasone as second and third line treatments.

Data Collection and Analysis

Data was retrieved from the medical notes, anesthetic record and observation charts. The demographic data analyzed included age, sex, ASA grade, indication for surgery, the surgical procedure performed and the operation duration. The primary outcome measure was verbal rating scale (VRS) pain scores on a scale of 0-10, one hour after surgery in recovery and at 6, 12, 24 and 48 hours postoperatively. Secondary outcome measures recorded were the total length of hospital stay (nights in hospital from the day of surgery to discharge) and adverse effects of TEA or PCA, namely nausea and vomiting requiring treatment with an antiemetic, hypotension (systolic BP < 100 mmHg) respiratory depression (respiratory rate < 10 breaths per minute) and pruritis.

STATISTICS

Demographic data is presented as median (interquartile range) or number (proportion) and analyzed by Mann-Whitney U-test. Pain scores are presented as means and 95% confidence intervals and analyzed by paired t tests.

RESULTS

Sixteen patients were identified having undergone laparoscopic colectomy. Eight had been managed with TEA and 8 managed with PCA. The demographic data of these groups is summarized in Table 1.

TABLE 1: Demographic data of patients managed with TEA or PCA following laparoscopic colectomy

	TEA (n = 8)	*PCA (n = 8)*	*p-value*
Age: years*	73 (54-77)	61 (31-68)	0.08§
Sex: M:F	4 : 4	5 : 3	
Procedure			
Segmental colectomy	7 (88%)	7 (88%)	
Subtotal colectomy	1 (12%)	1 (12%)	
Indication			
Malignancy	7 (88%)	7 (88%)	
Inflammatory bowel disease	1 (12%)	1 (12%)	
ASA grade			
I	1 (12%)	0	
II	5 (63%)	6 (75%)	
III	2 (25%)	2 (25%)	
Operation duration: minutes*	180 (156-190)	173 (139-240)	0.52§

Values are *median (interquartile range) or number (proportion). P values calculated using § Mann-Whitney U-test.

VRS pain scores and adverse effects of analgesia are shown in Table 2. VRS pain scores were significantly lower in the TEA group in recovery and at 6, 12 and 24 hours postoperatively. There was no significant difference in VRS pain scores at 48 hours, (Fig. 1). ANOVA also confirmed a significant difference in VRS pain scores in recovery and at 6, 12 and 24 hours post-operatively. There was no significant difference in mean hospital stay between the two groups. A number of patients in each group experienced adverse effects from analgesia (Table 2).

TABLE 2: VRS pain score, TEA/ PCA adverse effects and length of hospital stay for patients managed with TEA or PCA following laparoscopic colectomy

	TEA (n = 8)	*PCA (n = 8)*	*p value*
VRS pain score**			
Recovery	0 (0-0)	5.3 (3.6-6.9)	<0.0001¶
6 hours	1 (0-2.0)	5.4 (4.2-6.5)	0.001¶
12 hours	0.4 (0-1.1)	4.4 (3.3-5.4)	<0.0001¶
24 hours	1.3 (0-2.8)	5.9 (4.9-6.9)	0.002¶
48 hours	2.8 (0.8-4.7)	4.1 (2.5-5.8)	0.218¶
TEA/ PCA adverse effects			
Nausea and vomiting	2 (25%)	5 (63%)	
Hypotension	2 (25%)	2 (25%)	
Respiratory depression	0	0	
Pruritis	1 (13%)	0	
Length hospital stay (days)*	5(4-5)	4(3.3-6.8)	0.91§

Values are *median (interquartile range), **mean (95% CI) or number (proportion). P values calculated using ¶Paired t-test, § Mann-Whitney U-test.

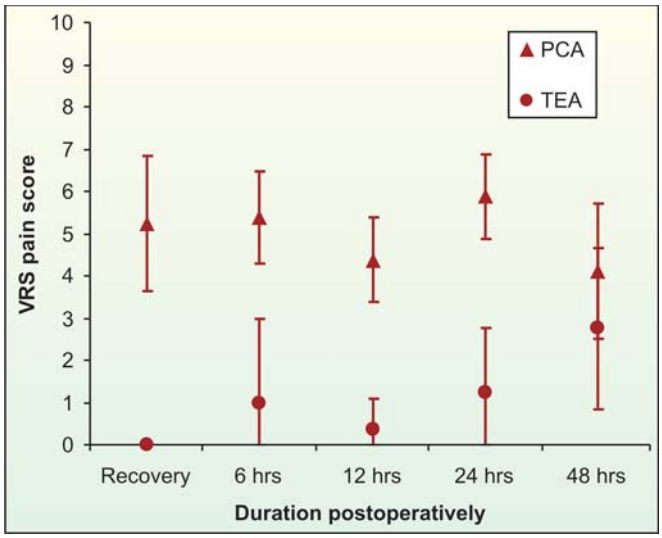

Fig. 1: Comparison of VRS pain scores for patients managed with TEA or PCA following laparoscopic colectomy. Data points represent means with 95% CI error bars.

DISCUSSION

This study shows that TEA provides significantly better pain relief compared to morphine PCA in the first 24 hours following laparoscopic colectomy. Our findings are consistent with the previous studies showing an analgesic benefit with the use of TEA.[6,7] We have also confirmed Taqi et al's findings that improved analgesia can be achieved with lower opiate dose epidurals and without the need for intravenous "rescue" opiate analgesia.

As well as the humanitarian argument in offering optimum pain relief to patients, the physiological benefits of improved pain relief with TEA following open surgery include reductions in the incidence of cardiac and respiratory complications[8] and a reduction in the duration of gastrointestinal ileus.[9] Although these benefits have only been proven to result in improved outcomes for high risk patients (ASA ≥ III) undergoing high risk surgery. There is evidence of similar improved outcomes with the use TEA in laparoscopic colectomy with a reduction in hospital stay[6] and accelerated return of bowel function and dietary intake.[7] However in our study the improved pain scores of the TEA group within the first 24 hours did not translate into a reduction in length of hospital stay (5 [4-5] vs 4 [3.3-6.8] days). This may be due to the small numbers in our study as the markedly higher mean pain scores within the PCA group (4.4-5.9 vs. 0-1.3) would be expected to reduce respiratory function and the patient's ability to mobilize. Length of hospital stay is also a crude measure of postoperative complications and may cover over differences in minor complications. Also of note the patients in our study were relatively young (73 yrs [54-77] and 61 yrs [31-68]) and fit (12 of 16 ASA I or II) which may mean as with open surgery the major benefits in terms of improved outcomes will be seen in high risk patients.

Adverse effects of analgesia were noted in significant numbers of patients in both groups. Hypotension was seen in both the TEA and PCA cohorts (2 [25%]). These figures are consistent with previously published incidences (37-80%) of complications due to autonomic blockade with the use of TEA.[8] There appeared to be a notably high incidence of nausea and vomiting associated with PCA. This is unsurprising given that this group of patients will have experienced much higher systemic concentrations of morphine. The use of fentanyl in the TEA infusion may also have been significant, given that it is associated with a lower incidence of nausea and vomiting in comparison to morphine.

Retrospective studies may be subject to bias in case selection. We have included all the laparoscopic colectomies performed at our hospital and excluded only those converted to open surgery. It should be remembered that a prospective study in this area would also be subject to bias since it is impossible to blind the patients or staff as to the analgesic technique. The staff caring for these patients were not aware of this study at the time of documenting pain scores.

CONCLUSION

Considerable pain is experienced after laparoscopic colorectal surgery and TEA offers superior analgesia compared to morphine PCA. Despite these proven benefits of epidural

analgesia it has been difficult to demonstrate an improvement in overall patient outcome with regard length of hospital stay. Attention has increasingly turned to improving quality of recovery and a return to normal level of functioning. A good measure of quality of recovery is the patients' level of pain relief and it is now accepted that patient satisfaction has become an indicator of quality of medical care. TEA appears to offer an optimum quality of care in recovery from laparoscopic colorectal surgery.

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Laparoscopic Surgery for Rectal Carcinoma—An Experience of 20 Cases in a Government Sector Hospital

Ashok K Mathur, Sameer Gupta, Nisar Ahmed, Asit Arora, Akshay Sharma

Upgraded Department of General Surgery, Unit 4, SMS Medical College, Jaipur, Rajasthan

Correspondance: Sameer Gupta, Room No.175, Resident Doctors' Hostel, SMS Medical College, Jaipur, Rajasthan
E-mail: Samsite@Indiatimes.com

Abstract

Objective: To assess feasibility, advantages, oncological safety, cost effectiveness and long term results of laparoscopic surgery for rectal cancer in a government sector hospital.

Method: From January 2005 to May 2007, 20 patients of operable cancer rectum were subjected to laparoscopic curative resection. Surgical technique, postoperative morbidity and clinical results were reviewed in close follow-up for median period of 20 months (12 wks to 30 months).

Results: Fourteen patients underwent LAPR and 6 patients LAR.

Median age was 39 years. Median operating time for Lap APR was 296 minutes, initial 7 cases taking an average of 368 minutes, while subsequent 7 cases average operating time was 232.5 minutes. In Lap AR, average duration of surgery was 356 minutes, first 4 cases taking 400 minutes while for last 2 cases, and mean operating time was 300 min.

There was no intraoperative complication in either group. All patients mobilized on POD: (1) Incidence of PONV was significantly less. Oral feeds were routinely started on POD, (2) Incidence of wound infection was also reduced (2/20). Hospital stay on an average was 11 days as ours being a government sector hospital, patients were discharged only after drain removal and thus stay was slightly prolonged. Of the 20 patients, 17 were diagnosed to be Adenocarcinoma, 2 with Malignant Melanoma and 1 with GIST. Two patients of malignant melanoma developed locoregional recurrence and 2 patients developed distant metastasis after approximately 1 year. No incidence of port metastasis in any patient.

Conclusion: Laparoscopic colorectal surgery is safe, feasible and meets oncologic requirements of radicality. Pattern of local recurrence and distant metastasis is similar to open surgery. Lap surgery has a steeper learning curve. Cost of treatment decreased by use of Ligaclips for intracorporeal vascular control and extracorporeal division of gut whenever possible.

Keywords: Rectal carcinoma; laparoscopy; anterior resection; abdominoperineal resection.

INTRODUCTION

Laparoscopic techniques have been attempted and applied to wide range of colorectal disease since first published study of laparoscopic colectomy in 1991 by Jacobs et al.[1] From its initial use in treatment of benign lesions such as diverticulosis, polyps, rectal prolapse and inflammatory bowel disease laparoscopic techniques are increasingly being applied for curative resection of colorectal cancer. Several advantages of laparoscopic colorectal surgery have been reported, including reduction of postoperative pain, shortened postoperative ileus, shortened hospital stay, better cosmesis and favorable effects on cytokine and hormonal responses.[2]

However, there were and still are strong reservations regarding laparoscopic rectal cancer surgery with focus on inadequate oncologic resection and risk of tumor cell spillage because of traumatic manipulation of tumor, putting patients at risk of developing early recurrences. Also laparoscopic colorectal surgery entails a long and steep learning curve for the surgeon.

However in a number of recent studies, laparoscopic and open excision of rectal cancer were found to be equivalent in achieving clear distal and radial margins, extent of resection, i.e. number of lymph nodes sampled, length of bowel and mesentery resected and bowel margins did not differ significantly between lap and open groups with satisfactory oncological control and functional outcomes.

We describe our experience with laparoscopic resection of rectosigmoid carcinoma in 20 patients in a Government sector hospital.

PATIENTS AND METHODS

From January 2005 to May 2007, 20 patients diagnosed to have rectosigmoid and rectal carcinoma, admitted in SU-IV of SMS Hospital, Jaipur were selected to undergo laparoscopic curative resection. Of these, 7 patients underwent lap anterior resection and 13 patients underwent lap APR, based on preoperative

evaluation and distance of tumor from anal verge. In case of ultra low rectal tumors (< 3 cm from anal verge), APR was performed. For tumors > 3 cm from anal verge, sphincter preserving TME was routinely attempted unless there was clinical involvement of anal sphincter muscles.

Exclusion Criteria

1. Presence of distant metastasis
2. Locally advanced disease with invasion into adjacent pelvic organs
3. Acute bowel obstruction or perforation from cancer
4. Severe medical illness.
   a. All patients provided written informed consent.
   b. All patients were evaluated before operation by colonoscopy/Ba Enema and abdominal USG. CT abdomen was routinely done to rule out metastatic disease and to look for evidence of local infiltration, gauge the size of tumor and regional lymph node involvement.
   c. CEA levels were routinely noted preoperatively
   d. Preoperative biopsy were routinely taken
   e. All patients received mechanical bowel preparation day before the operation. Systematic prophylactic antibiotics were given i.v. few hours before surgery.
   f. Urinary catheter and nasogastric tube were routinely used. Neoadjuvant treatment was not routinely offered.

OPERATIVE TECHNIQUE

Operation time was taken as time from first incision to completion of last stitch. Most of laparoscopic procedures were performed by a surgical team consisting of one surgeon and two assistants. Patient was placed in head down Lloyd-Davies Trendelenburg position with surgeon and camera assistant on patient's right side. 5 ports were routinely used with subumbilical port used for 30° angled telescope. No deviation from basic principles of open oncologic colorectal surgery was permitted and performed as follows: Laparoscopic abdominal exploration, preliminary identification and transaction of IMA and IMV with clips, mobilization of left hemicolon and splenic flexure, identification of ureters and hypogastric nerves bilaterally, rectal mobilization (for higher lesion mesorectal tissue down to 5 cm below tumor routinely excised and TME in tumors of middle and distal third) and intracorporeal transection of rectum with an endoluminal stapler in case of restorative resection. Abdomen opened by extension of umbilical port wound (max 5 cm length) and resection completed extracorporeally, delivering tumor bearing bowel under protection of plastic bag. Anvil of circular stapler inserted into proximal bowel, gut put back in peritoneal cavity, pneumoperitoneum reestablished and intracorporeal anastomosis done with stapler (CDH 29). For ultra low AR, temporary diverting loop ileostomy used.

In patients with APR, pelvic dissection done as far distally as possible abdomen opened by extension of port in left lower quadrant, descending colon transected extracorporeally and end colostomy created. Conventional perineal dissection and delivery of specimen through perineal wound. Perineal drains routinely used. Throughout the surgery meticulous hemostatis was maintained to prevent light absorption by hemoglobin which reduces picture quality.[3]

Occurrence of general and surgical complications recorded. General complications were defined as pleural effusion, pneumonia, infection of central line, DVT.

Surgical complications were defined as intraoperative complication as injuries to neighboring organ, and preoperative surgical problems as bleeding, wound infection and ileus.

RESULTS

During 30 month period, 20 patients were operated for tumors of rectosigmoid and rectum. Of these 20 patients, 17 had adenocarcinoma, 2 showed malignant melanoma and 1 patient had GIST. In all patients intervention was done with curative intent.

Average operative time for LAPR was 296 minutes with a range of 180-600 minutes. Initial 7 cases took an average of 368 minutes while subsequent 7 cases took 232.5 minutes which compares favorably with the operating time of any high volume center. Average operating time for LAR was 356 minutes with range of 330-540 minutes. First 4 cases took 400 minutes while last 2 cases took 300 minutes on an average.

Thus there was a significant reduction in operating time with increase in cumulative experience and refinement in surgical technique, in latter half of the observation period. Average blood loss was 200 ml (50-400) (Table 2).

There was no intraoperative complication in any patient. One patient of LAPR needed conversion to open surgery because of advanced disease. Extent of bowel resection (Avg = 19 cm) was comparable to extent of resection given in literature with no incidence of positive resection margins. Average lymph node harvest examined per specimen was 5.

Perioperative recovery was remarkable with only 7 patients out of 20 needed to be shifted to ICU, 7 patients requiring perioperative blood transfusion. All patients were mobilized by POD 1, average analgesic requirement was 2 injections. There were no complaints of postoperative nausea and vomiting, usually started taking oral sips by POD 2/3 and normal diet was usually by POD 5.

Incidence of wound infection was also significantly less (2/20). There was no 30 day postoperative mortality and no significant early postoperative complications. Over median 20 months period of follow up, 1 patient of LAPR reported back with prolapsed and obstructed colostomy for which he underwent revision colostomy. One patient of LAR had iatrogenic colonic perforation during routine postoperative colonoscopy for which re-laparotomy was done.

1. No incidence of port site metastasis.
2. Two patients with malignant melanoma reported local recurrence and 2 patients reported liver metastasis after approximately 1 year (one of GIST and other of Adenoca.
3. Three cancer related mortality
4. Average follow-up was 20 months (longest follow-up being 30 months) (Table 1).

DISCUSSION

Open surgery was the gold standard in colorectal cancer but the laparoscopic surgery for colorectal cancer has gained wide acceptance over last decade. Just as laparoscopic surgery has revolutionized the practice of biliary surgery in recent past; it is all set to take colorectal surgery by storm.

In our series, 20 cases of rectal carcinoma were subjected to Laparoscopic Anterior Resection or Abdominoperineal Resection, the results supports use of laparoscopic technique.

After almost 10 years of clinical application, use of laparoscopy for treatment of colorectal cancer is still controversial because long term outcome in malignancy is of overwhelming importance compared with potential benefits obtained in the early postoperative course and advantages in cosmesis.[4] There were serious concerns about potential inadequacy of resection, possible staging inaccuracies or possibility that use of pneumoperitoneum altered the patterns of tumor dissemination.[5]

This is true for colon cancer and even more so far rectal cancer which is much more of challenge for laparoscopic surgeon because of steep learning curve it entails, need for intracorporeal vascular control and dissection in limited space in pelvis, particularly in male patients. However, there are now numerous reports of successful rectal surgery by laparoscopic route which prove the technical feasibility of this approach.[6,7]

Appealing operation early in the laparoscopic proctectomy was abdominoperineal resection (APR). LAPR has a number of decisive advantages in comparison with other colorectal procedures as difficult technical problem of anastomosis is obviated whereas the perineal aspect of rectum amputation remains unchanged and it is possible to complete TME via perineal approach. In addition, recovery of the resected specimen is unproblematic and no additional abdominal incision is required. Finally, laparoscopic manipulations involve only non tumor bearing segments of the bowel.[12]

In non-randomized comparative studies, laparoscopic and open excision of rectal cancer was found to be equivalent in achieving distal and radial negative margins.[8]

Adequacy of radial resection can also be measured by ability to achieve high ligation, specimen characteristics and lymph node yield which in many recent studies have shown to be comparable in open and laparoscopic group.[8]

In vast majority of reports, postoperative mortality rates following laparoscopic rectal cancer excision were low—overall mortality rate in the literature is 1.3%[8] (Table 3). Laparoscopic approach did not jeopardize outcomes with probabilities of survival and being disease free at 5 years being as good as that for open resection.[9] Patterns of recurrence do not appear to be different between laparoscopic and open colectomy and incidence of port site recurrence in recent studies has been approx. 0.1% or less.[10]

TABLE 1: Patients data—baseline characteristics

1. Number of patients	20
2. Male/Female ratio	16/4
3. Age, Mean (range)	39 year (29-65 yrs)
4. Symptoms	
• Blood in stools	18 (90%)
• Anal discomfort	13 (65%)
• Altered bowel habits	14 (70%)
• Anal pain	5 (25%)
5. Previous abdominal surgery	7 (35%)
6. Preoperative Hb (g/dl)	10.96 (5.8-17.2 gm/dl)
7. Preoperative CEA (ng/ml median)	3.40 (0.6-37 ng/ml)
8. Location	
• Rectosigmoid/upper rectum (16-12 cm)	3
• Middle rectum (11.9-8 cm)	4
• Lower rectum (7.9-4 cm) and anal canal	13
9. Preoperative radiochemotherapy	1
10. Grade of differentiation	
• Well	3
• Moderately	14
• Poor	1
• Undifferentiated	2
Unknown	–

TABLE 2: Perioperative data

	Own experience n =20	*Dis colon rectum 2003;46: n =101*	*Lancet 2004; 363 n =203*
Operative time	335 min		
• LAPR	296 min (180-600)	217.9 ± (70.9)	190.9 min
— Initial 7 cases	368 min		
— Last 7 cases	232.5 min		
• LAR	356 min (330-540)		
— First 4 cases	400 min		
— Last 2 cases	300 min		
Blood loss (ml)	250 (50-500)	200 (0-600)	169 (0-3000)
Intraoperative blood transfusion	7	4	
Diverting Ileostomy (LAR)	2/6	39	
Conversion	1	11	
Anastomotic leakage	0	1	1
Length of tumor bearing bowel (cm)	18.93	23.6±7.3	
• LAPR	22.3		
• LAR	13.3		
No. of resected lymph nodes	5 (0-21)	15	11
Histology			
• Adeno CA -	17		
— Duke's stage A	-		
B	11		
C	6		
• Malignant melanoma		2	
GIST		1	

TABLE 3: Postoperative data

Patient in ICU	7/20	–
Length of stay in ICU	2 days	1-3 days
Length of hospital stay	11 days	6-20 days
Postoperative analgesics need	2 injections	0-4 inj.
Time first passing flatus	POD 2	1-4 days
Time first passing motion	POD 3	2-5 days
Time to resume normal diet	POD 5	2-7 days
Time for ambulation	POD 1	0-3 days
Incidence of postoperative nausea vomiting	4 patients	-
Wound infection	3	-
Other complications		
• Colostomy prolapsed	1	
• Releparotomy	2	
• Postoperative obstruction	2	
• Urinary complaints	1	
Recurrence		
• Port site	0	
• Local	2	
• Distant	2	
Mortality		
• Operative	0	
• Cancer related	3	
Postoperative chemoradiation	10	
Mean follow-up	20 (longest follow-up being 30 months)	

Potential benefits in terms of improved cosmesis, reduced postoperative pain, early return of bowel activity, earlier functional recovery and shortened hospital stay are proven benefits of laparoscopic colorectal surgery.[11] Comorbidity does not appear to be a major obstacle for laparoscopic technique and even elderly patients with comorbidities may be benefited with reduced postoperative morbidity.

With magnified view and improved visualization of deep pelvic structures under laparoscope, laparoscopic rectal cancer excision should yield functional outcomes at least comparable

to, if not better than open surgery.[8] Thereby postoperative genitourinary dysfunction after rectal cancer surgery, which is of paramount importance from patient's perspective can be minimized.

Two most commonly identified surgeon-specific factors that are associated with good outcome in laparoscopic rectal surgery have been speciality training and high case volume. Technique of mesorectal mobilization and resection has been demonstrated to have prognostic significance.

In the beginning, favorable cases should be preferred for laparoscopic approach, viz. female patients and normal weight male patients with proximal rectal cancers. After sufficient experience, even over weight male patients and patients of either gender with tumors in middle and third can be included.[4]

Operation time in early cases was longer because of limited experience but we believe that overall operations times of 150-180 minutes can be achieved routinely by further refinement of the technique.

One major concern regarding laparoscopic surgery is cost effectiveness and this issue is currently under investigations. Indeed, laparoscopic procedure itself is more expensive than conventional techniques because of the use of single use trocars and endoluminal staplers. However, when one taken into account ICU stay and overall hospital stay laparoscopic procedure is significantly superior, bringing considerable savings to the budget. Moreover, treatment can be further economized by increased use of Ligaclips for intracorporeal vascular control rather than using vascular cartridges and extracorporeal division of gut whenever possible.

CONCLUSION

The limited experience and recent studies in literature have clearly shown that with laparoscopic technique, all oncologic principles of rectal cancer surgery could be followed. With regard to morbidity, local disease recurrence and survival figures, laparoscopic surgery is atleast comparable with open surgery and it offers distinct advantage in early postoperative period and in terms of cosmesis.

Wise selection of appropriate cases should guide the novice in advanced laparoscopic surgery. Performing 20 procedures is necessary to attain the level of expertise required to undertake laparoscopic resection of colorectal cancers on a curative basis. Thus, with development of improved techniques and more experience, operating time can gradually be reduced with improved outcomes.

Thus it can be safely said that with weight of numerous recent large-scale trials behind us and our own experience, laparoscopic approach is an acceptable alternative to open surgery for colorectal cancer.

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