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Surgeon's physical and mental stress while performing laparoscopic cholecystectomy

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Abstract

Background: Laparoscopic cholecystectomy is performed either by four port or three port. Although the overall patient outcome has been studied with comparable results, surgeon's stress level has not been addressed commonly.

Objective: To compare the difference in surgeon's physical and mental stress between three port and four port laparoscopic cholecystectomy.

Methods: This prospective randomized comparative study was carried out from January 2014 to August 2014 in patients undergoing laparoscopic cholecystectomy with American technique. Patients were randomized into four port laparoscopic cholecystectomy group and three port laparoscopic cholecystectomy group. Surgery was performed by experienced laparoscopic surgeons. At the end of procedure, surgeons were given questionnaire to evaluate physical and mental stress faced by them based on Visual Analogue Scale. The results obtained were compared.

Results: Total 60 cases were evaluated, 30 in each group. Mean age of patients and American society of Anesthesiologists score were not different. Surgeon's perception regarding physical and mental stress while performing in two different groups was analyzed. The difference is not statistically significant. Neither any of the three port group needed to add additional port nor any of the patients were converted to open surgery. None of the patient in either group developed clinically significant complication.

Conclusion: Both the four and three port laparoscopic cholecystectomy techniques are comparable in regards to patient outcome as well as to the physical and mental stress experienced by the surgeons.

Key words: Cholecystectomy, Laparoscopy, Mental stress, Physical stress.

INTRODUCTION

Surgery is both mentally and physically demanding for the surgeons. Primary focus of evaluation of surgical procedure has been patient outcome. Recently literatures are coming up concerning the adverse effects to the surgeons because of surgical procedure, as the surgery is known to inflict considerable amount of stress to the surgeon[1-3]. Adverse effect of surgical procedure on surgeon's physical and mental status may have detrimental effect on patient outcome because of impaired judgments and decision making[3, 4]. Surgical experience, personal coping strategies, the magnitude of procedure and the surrounding environment are known to cause variable amount of physical and mental stress on the surgeon[1,2,4,5]. Work related physical and mental stress has a negative impact on general health of surgeons, quality and safety of operation[6,7]. Impairment of judgment is significant among inexperienced surgeons because of mental stress[8] while experience definitely increases efficiency[9].

Laparoscopic cholecystectomy is one of the most frequently performed operations and most of the other operations are also being performed using laparoscopic technique in spite of it being more stressful for the surgeons than open surgery[1, 10]. Generally laparoscopic cholecystectomy is performed using four ports. As surgical practice continues to evolve towards less invasiveness, attempts are being made to minimize the invasion by reducing the number of ports to three, two and even one. Several reports of feasibility and potential benefits to patient are available in reduced port surgery[11-16].

However, effect of reducing port on physical and mental stress of surgeons during these procedures still eludes

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literature. Therefore, we plan to conduct a randomized control trial to evaluate the difference in physical and mental stress on surgeon during four port and three port laparoscopic cholecystectomies.

METHODS

The study was carried out between January 2014 and August 2014 in the department of Surgery at Kathmandu Medical College. All the patients who were eligible and undergoing laparoscopic cholecystectomy except the patients with previous abdominal scar suspected Mirizzi syndrome and those converted to open procedure were included. Permission was taken from Institutional Review committee (IRC) and informed consent was obtained in all the cases. Eligible patients were randomized into two groups, Group 1, three port laparoscopic cholecystectomy (TPLC) group and Group 2, four port laparoscopic cholecystectomy (FPLC) group. All patients underwent basic investigations such as blood test, abdominal ultrasound, chest x-ray, ECG and others as per the need. All operations were performed by any one of three experienced surgeons among authors, who have an experience of at least 500 laparoscopic cholecystectomies. Surgeon's experience about stress level was recorded in the Visual Analogue Scale (VAS). For the assessment of mental stress following parameters were used: Assessment of time pressure, feeling to make an extra effort in surgery, opinion regarding one's own performance, feeling of frustration, satisfaction about personal performance and feeling about whether the alternative procedure would have been easier. For the assessment of physical strain: feeling of strain in hand, lower arm, shoulder, neck and back were assessed. Patient related factors and technical factors which might have affected the surgical outcome were also recorded. The parameters included were patient related problems (unclear calot's triangle, difficult anatomy, intrahepatic gall bladder, peri-cholecysticadhesions etc), equipment failure (insufflation problems, failure to maintain adequate pneumoperitoneum, fogging of lens etc), team work problem (novice assistants, inexperienced staffs etc), distraction by people in operation theatre and time management (pressure to finish operating list, delay caused by various factors etc).

At the beginning of study, 60 pieces of paper were taken. In 30 pieces, TPLC was written and in remaining 30, FPLC was written and folded. These were put in a box. Just before starting surgery a lottery was drawn by an independent volunteer present in Operating Room and patients were grouped in Group 1 or Group 2.

OPERATIVE TECHNIQUE:

All the patients were admitted one day prior to surgery. They were counseled, pre-anaesthetic medication were given and kept overnight fasting. All patients were given general anaesthesia. Surgical procedure was as per standard American technique. In this technique, patient is in supine position, surgeon and camera person on left side of patient and an additional assistant if required on right side. A 10 mm infra-umbilical, a 10 mm sub-xiphoid and a 5 mm right subcostal port were placed in TPLC group where as an additional 5 mm port was placed in right lumbar region along anterior axillary line in FPLC group. Ten mm infra-umbilical port was used to introduce laparoscope. Ten mm sub-xiphoid port and 5 mm right subcostal port were used for dissector and Babcock forceps respectively. In FPLC group the additional right lumbar port was used to grasp and retract fundus of the gall bladder. In TPLC, Hartman's pouch was retracted by right subcostal port and Calot's triangle was dissected to identify cystic duct and artery to achieve critical view of safety. Cystic duct and artery were clipped by introducing clip applicator from 10 mm sub-xiphoid port and were divided. Gall bladder wasdissected from gall bladder bed by using monopolar diathermy. The gall bladder was removed through infra-umbilical port. Only the umbilical port was sutured with polyglactin thread no. 1. Skin incision suture was closed with skin stapler.

At the end of procedure, the questionnaire list was given to surgeon containing questions concerning physical and mental stress addressing above given parameters. The questions included were related to both physical and mental stress. Score for different parameters were recorded based on VAS.

The results obtained at the end of study were listed in table and analyzed usingt-test in Statistical Package for Social Science (SPSS) 20.

RESULTS

Out of total 60 cases, 30 were in TPLC and 30 in FPLC group. The median age of the three operating surgeons was 40 years (36-44). All surgeons were in good physical and mental health with almost similar height and weight. They have experience of performing laparoscopic surgery for more than 5 years and more than 500 laparoscopic cholecystectomies. The mean age of patients in TPLC was 41 years and FPLC was 47 years which is comparable. Female to male ratio in the series was approx. 3:1 (Fig.1). Patient's category according to American Society of Anesthesiologist (ASA) is given in

Table 1. All the patients were in ASA1 and ASA 2 category. Duration of surgery in both the group is compared in table 2.

The difference in subjective parameters of the surgeons for the evaluation of mental stress is given in table 3 and physical strain between two groups is given in table 4. Patient parameters that increased the physical and mental strains are given in table 5. Difference of any of the parameters used for physical and mental strain was not found to be significant between two groups.

Table 1: Grouping according to ASA.

ASA Grading	Group		Total
	Group 1(TPLC)	Group 2(FPLC)	
ASA1	27 (55.1%)	22 (44.9%)	49
ASA2	3(27.2%)	8(72.7%)	11

Table 2: Comparison of duration of surgery between the two groups

	Port Number	N	Mean	Standard Deviation (SD)
Duration of Surgery (Minutes)	TPLC	30	43.77	23.881
	FPLC	30	46.57	21.866

***p*-0.638**

Table 3: Comparison of different parameters for mental strain between two groups based on VAS.

	TPLC Mean±SD	FPLC Mean±SD	t-test for equality of Means			
			t	95% confidence interval of the difference		*p*-value
				Lower	Upper	
Time pressure during procedure	1.00±0.98	1.17±1.7	-1.105	-1.124	0.324	0.274
Stress level to make effort for procedure	2.33±2.4	1.80±2.1	-0.272	-1.113	0.847	0.786
Self-Grading of performance	7.83±2.4	8.03±1.96	1.683	-0.234	2.700	0.098
Level of Frustration experienced	2.03±2.4	1.30±1.6	-1.570	-1.289	0.156	0.122
Level of Work satisfaction	8.50±2.1	9.33±1.2	0.139	-1.788	2.054	0.890
Level of feeling whether Open procedure would have been easier	1.43±1.9	0.83±1.2	-0.823	-0.915	0.382	0.414

Table 4: Comparison of different parameters for physical strain between two groups based on VAS.

	TPLC Mean ± SD	FPLC Mean ± SD	t-test for equality of means			
			t	95% confidence interval of the difference		*p*-value
				Lower	Upper	
Hand Strain	1.40±0.7	1.30±0.7	-0.512	-0.983	-0.583	0.611
Arm Strain	1.20±0.4	1.13±0.3	-0.759	-01.091	0.491	0.451
Shoulder Strain	1.37±0.6	1.30±0.5	-1.187	-1.164	0.298	0.240
Neck Strain	1.37±0.7	1.23±0.6	-1.484	-1.096	0.163	0.143
Back Strain	1.17±0.9	0.93±0.8	-1.596	-1.428	0.161	0.116

Table 5: Comparison of different factors (patient and operative room factors) causing impact on physical and mental status of operating surgeons observed by surgeons based on VAS.

	TPLC Mean±SD	FPLC Mean±SD	t-test for equality of Means			
			t	95% confidence interval of the difference		*p*-value
				Lower	Upper	
Patient related problem	2.47±1.2	2.23±0.9	-0.291	-1.578	1.178	0.772
Technical Failure	2.37±0.9	2.37±0.8	0.585	-0.807	1.474	0.561
Team work incoordination	2.20±1.1	2.33±1.2	-0.549	-0.441	0.774	0.585
Distraction during procedure in Operating Room	1.97±1.4	1.77±1.4	1.329	-0.253	1.253	0.189
Level of stress for Time Management	2.27±1.1	2.23±1.1	0.363	-1.205	1.738	0.718

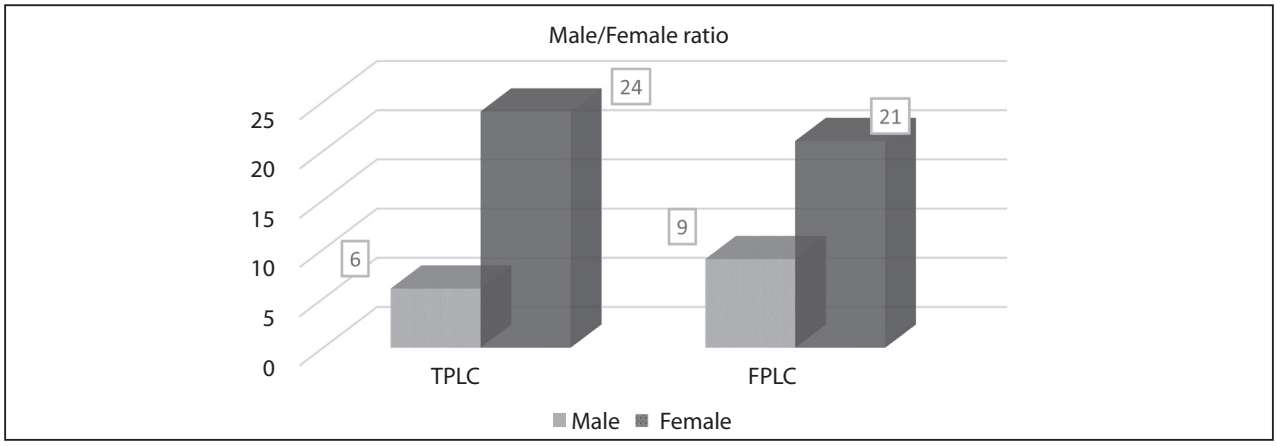

Figure 1: Demonstrating male and female ratio between the two groups

DISCUSSION

The surgeons are considered to be an example of a person who is determined, professional, able to remain controlled under adverse situations and willing to work extra time without any prior schedule. These may be true for most surgeons. But this is associated with extra stress on the surgeons. There have been many investigations for stress related problems for scientists but this is lacking in case of surgeons which is clearly reflected by scarcity of published studies[17]. The large study in University of Michigan in 2001 which surveyed 582 surgical trainees reported 32% presented with emotional burnout and 13% suffered from depersonalization[18]. Even with these findings, less attention has been paid in this area. The explanation given is that the doctors are "shy" to admit their own stress and they are more reluctant to follow interventional non-pharmacological based programs. The surgeons are habituated to come up with own strategy to decrease stress level when they have it[4].

The minimal invasive surgery (MIS) like laparoscopic and endo-surgery is continuously evolving. There have been many studies regarding the safety of different techniques of laparoscopic surgery in relation to outcome of the patient[17]. Learning and practice of MIS has posed difficulties for novice surgeons and trainees and also challenging for proficient surgeons, thus it has forced surgical profession to investigate for better understanding of the factors that compromise operator learning and performances. In the experimental models, the attentional capacity has been found increased with training into simulator while the factors that increase stress level are found to be due to unfamiliar or dysfunctional operating equipment (like instrument that misfire), unfamiliar operating room with unfamiliar staff or performing unfamiliar procedure[19]. Video-endoscopic surgeries are significantly more stressful and give more physical and mental stress to the surgeons than open surgery. In general, 40-60% of laparoscopic surgeons experience occupational injuries like digital nerve injuries[10, 20, 21].

It has been widely observed that the patients of laparoscopic procedures experience less pain, shorter hospital stay, and return to normal activity much faster when compared to open procedures. This fact led the surgeons to make further efforts to minimize the number and size of the port as well as the sizes of devices believing

that less injury to the body wall results further reduction of surgical invasiveness[22]. Although the number of port should not be an issue for performing safe laparoscopic surgery and this can be increased according to the need, there is always attraction towards reduced port numbers from cosmetic as well as technical point of view. Three port (even two port) laparoscopic cholecystectomy is being practiced in many centers, and they report its been better or, at least, comparable to the standard four port procedure[12,23].

Laparoscopic cholecystectomy is performed either by French technique where patient is in supine position with legs apart on stand, the operating surgeon standing in between legs of patient or by American technique where patient is kept in supine position and surgeon on left side of patient. In our unit, we do almost all laparoscopic cholecystectomies as per American technique. In this, fourth port is used for the instrumentsto grasp the fundus of gall bladder and pushed upwards and outwards for better exposure of Calot's triangle whereas in French technique fourth port is used to retract the liver. But soon after the laparoscopic surgery gained popularity, many surgeons realized that the fourth port has a minor role and decided to omit it and do the surgery with three ports only. Reports have proved its safety and feasibility[11].Three and four port laparoscopic surgeries have been compared in many studies for technical feasibility and patient outcome. Studies are unable to show any difference[24-26].

However, there had not been any study regarding the impact of these two types of procedure (three port and four port) in relation to surgeon's stress. We carried out this study for the comparison of physical as well as mental stress experienced by surgeons while performing surgery either using four or three ports. We have tried to minimize other compounding factors which might influence the surgeon's stress level as far as possible. In this study, there is similarity in ASA grading of the patients (Table 1). The mean duration of surgery is also comparable. All the surgeons were experienced laparoscopic surgeons as mentioned. Demography of the surgeons are also similar. During the study not a single case had to be converted from three to four ports or to open.

This study was unable to show the difference in the performance and physical and mental stress faced by the surgeons between the two groups (Table 3,4,5). Laparoscopic surgeries cause high level of mental and physical stress. One of the recognized factor is duration of surgery exceeding 4 hours, where surgeons develop "Surgical fatigue syndrome" which is characterized by mental exhaustion, reduced dexterity and a reduced capacity for good judgement[27]. None of our patients were operated for so long. This obviates the fatigue syndrome in our study. Other factors identified as responsible for increased stress in laparoscopic surgery are: Two-dimensional viewing for a three-dimensional operating field, tip of instrument moving in opposite to the handle i.e. "the fulcrum effect" and surgeons requiring to monitor different devices at the same time[28]. Some studies have used skin conductance level and electro-oculogram monitoring to measure the mental stress of surgeons[29]. VAS for measuring stress is a simple, reliable clinical tool for the assessment of occupational stress and has been tested in many studies[30].

We analyzed the reason for not getting any difference in stress level of the surgeons although it is a general rule that the addition of ports make the work easier. This might be because the participating surgeons in the study were routine practitioners of 3-port surgery. Adding another port for them probably would not have made any difference. Basically, the experiment for them is not the reduction of ports rather it is the increment of the number of ports. We think this may be the reason that the surgeons did not experience the difference in their physical as well as mental stress level. So, randomization of not only the patient but surgeon's randomization is also needed.

LIMITATIONS

Few limitations we could assess are: One, this is a small scale study. Two, the study has relied on the questionnaires to explore the concept of stress which are purely work related whereas typical stressors identified as surgeon's personal life, workload and wellbeing are not focused on[31-34].

CONCLUSION

Both the four and three port laparoscopic cholecystectomy techniques are comparable in regards to physical and mental stress experienced by the surgeons and patient outcome as well. However, the larger scale study is needed involving equal number of surgeons with equal experience of both four and three port surgery to highlight on the subject.

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