Original Article

Laparoscopic Cholecystectomy in High Risk Cardiac Patient with DM

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Abstract

Introduction: *Laparoscopic cholecystectomy remains the standardtreatment for cholelithiasis. Ever increasing number of patients with myriad of medical illness is being treated by this technique. However, significant concern prevails among the surgical community regarding its safety in patients with cardiac co-morbidity. Patients with diabetes, significant cardiac dysfunction and multiple co-morbidities were prospectively evaluated. Patients were assessed by cardiologists and anesthesiologists and laparoscopic cholecystectomy was performed.*

Results: *Patient demographics, details of peri-operative management and post-operative complications were studied.Between July 2014 and January 2018, 32 patients (M:F=24:08) with mean age of 55 years (range 36–78) and having significant cardiac dysfunction had undergone laparoscopic cholecystectomy. Of these, 24 patients were in NYHA class-II, while 8 belonged to class-III. Left ventricular ejection fraction, as recorded by transthoracic echocardiography, was20–30% in 08 (25%) patients and 30–40% in the rest 24(75%). In addition, 21 (71%) patients had regional wall motion abnormalities, 11 (34%) patients had cardiomyopathy while 09 (39%)patients had prior cardiac interventions. Following laparoscopic cholecystectomy, hypertension (21), tachyarrhythmia(4) and bradycardia (2) were the commonest events encountered.Two patients required dopamine in the immediate postoperative period but all other patients made an uneventful recovery.*

Conclusion: *With appropriate cardiological support, laparoscopic cholecystectomy may be safely performed in patients with significant cardiac dysfunction.*

Keywords: *Laparoscopy, Cholecystectomy, High Risk Cardiac Patient.*

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Introduction

Laparoscopic surgery has become very popular as its advantages include minimally invasive nature, less postoperative pain, early return to activities, less postoperative ileus, less wound infections and superior cosmesis[1]. Since the introduction of laparoscopic cholecystectomy by Philip Mouret in 1987, the technique was rapidly acceptedby the surgical community[2]. The appeal of diminishedpain and fatigue, early return to normal activities andsuperior cosmesis has made it a popular surgery[3].Previous abdominal surgery, acute cholecystitis[4], morbidobesity[5], old age[6] and pregnancy[7] were traditional contra-indications for laparoscopic cholecystectomy.

However,in the recent years, development of surgical skills andbetter understanding of the pathophysiology of pneumoperitoneumhave made it possible to offer laparoscopiccholecystectomy to patients suffering from myriad ofmedical illness.

Nonetheless, concerns remain about thesafety of this technique in patients with cardiac comorbidity.

Diabetes mellitus is the most common endocrine abnormality encountered in surgical patients and is associated with increased perioperative morbidity and mortality mainly due to the complications of the disease.

Diabetic patients frequently have cardiovascular disorders such as hypertension, ischaemic heart disease and left ventricular dysfunction and very often associated with autonomic neuropathy which may aggravate during pneumoperitoneum. Therefore effective measures are to be sought to reduce these responses and minimize intra-operative hazards.

During laparoscopy, positive pressure pneumoperitoneumusing carbon dioxide could have deleteriouseffects on the cardiovascular system [8]. Therefore, standard text books often cite patients with cardiacdysfunction a relative contraindication to laparoscopiccholecystectomy [4]. Similar anxiety also prevails amongstthe surgical and anaesthetist community and laparoscopiccholecystectomy is often discouraged in patients withsignificant cardiac diseases.

On the contrary, the physiologicalstress following minimally invasive surgery is lesseras compared to patients undergoing open cholecystectomy[9–11]. This begs the question whether the purported risk ofpneumoperitoneum could be offset by the diminished stressfollowing minimally invasive surgery, thereby bringing thepatients with cardiac co-morbidity within the ambit oflaparoscopic cholecystectomy. This prospective study wasundertaken in a tertiary care hospital to evaluate thesafety of laparoscopic cholecystectomy in patients withischemic heart disease and significant cardiac dysfunction.

Materials and Methods

This observational study was started inJuly 2016. Since inception, patient demographics, operative data and post-operative course of all patients wereprospectively recorded in a computerised database.Pre-operative Assessment Patients with significant ischemicheart disease were evaluated by resting ECG andtransthoracic echocardiography. They were subsequently evaluated by cardiologists and anesthetist in pre anesthetic check up.

Thepatients were grouped according to the New York HeartAssociation (NYHA) functional classification system[12]. For this study, patients belonging to NYHA II and III wereincluded. Diabetic was controlled by short acting insulin and other associated systemic diseases (like HTN, Br. Asthema) if present wereoptimized by taking consultation from respective consultant. Patients on antiplateletdrugs were asked to stop these medicines 5 days beforesurgery. Beta-blockers were started preoperatively in thosewho were not receiving such drugs previously. Patients onanti-coagulants were switched over to some form of heparinaccording to standard dosage schedule and were taken upfor surgery when international normalized ratio (INR) fellbelow 1.5.

All patients were premedicated with Midazolam(7.5 mg), Ondansetron (4 mg) and Omeprazole (20 mg) inthe night before surgery and cardiac medications, exceptangiotensin converting enzyme inhibitors, were continuedtill the morning of surgery.

Operative management laparoscopic cholecystectomy wasperformed early in the morning after a minimum of 4 hoursof fasting. Venous access was obtained with an 18 Gperipheral venous cannula. Monitoring was started with the patient awake, pulse oximeter, temperature, noninvasive blood pressure (BP), and fivelead electrocardiogram (ECG).

In patients who have had permanent pacemaker implanted, the mode waschanged to fixed mode prior to surgery. Arrangement oftemporary pacing, defibrillator and syringes with preloadedlife saving drugs were kept ready. After preoxygenationwith 100% oxygen, anaesthesia was inducedwith Fentanyl (2–3 mcg/kg), midazolam 0.03 mg/kg and Propofol(1-2mg/kg) IV slowly. Atracuronium(0.5 mg/kg) was used for intubation/ Laryngeal mask insertion while anaesthesia wasmaintained with Oxygen, continuous propofol pump, intermittent Atracuroniumand Fentanyl. Heart rate, blood pressure, oxygensaturation, ECG and end-tidal CO2 (ETCO2) were monitoredcontinuously (Philips®, MP20, Germany). Intravenous crystalloid solution administeredcautiously. All patients were mechanically ventilated andETCO2 was maintained between 30–35 mmHg. Standard 4-port laparoscopiccholecystectomy was performed. Theinitial intra-umbilical camera port was introduced using theopen technique[12]. Carbon dioxide insufflation wasinitiated and maintained at 5 litres/min and other portswere introduced under vision. The higher limit of intra-abdominalpressure was kept at 8 mmHg and surgery wasperformed in 15°-20° reverse Trendelenburg position withright tilt.

The following parameters were measured heart rate (HR),BP, SpO2, peak airway pressures (PAPs), and lungcompliance.

Upon completion of surgery, peritoneal carbondioxide was released very slowly.Post-operative Management after the procedure, patientswere closely monitored in the post-anaesthetic care unit for 4to 5 hrs. Majority of the patients were shifted to the ward,while those with troubled intra-operative course were shiftedto SICU for overnight observation. Adequate post-operativeanalgesia was ensured bycontinuous intravenous morphine (1 mg/hour) in the immediate post-operative period with oral paracetamol (10 mg/kg/dose) was administered subsequently.

Intravenous fluid was continued till the evening whileoral intake was commenced after 4–5 hours. Anticoagulants and insulin were started according to well described guidelines.

Results

Between July 2016 and December 2018, a total of 3287 diabetic patients underwent laparoscopic cholecystectomy. Of these, 665 patients gave history of ischaemic heart disease, 11 patients had dilated cardiomyopathy, well maintained on cardiac medicines, 38 had undergone coronary artery bypass grafting while 58 patients had angioplasty and stenting in the past.

Amongst this heterogenous group, 32 patients belonging to NYHA grade II (24 patients) and grade III (8 patients) were included in this study (Table 1). The mean age was 55 years (range 38–76) with a striking male preponderance. Ten (31%) patients had some kind of cardiac intervention prior to surgical referral while the rest were under medical management. Two patients had bifascicular block but did not require temporary pacemaker during the perioperative period (Table 2). Transthoracic echocardiography showed a left ventricular ejection fraction of 20–30% in 08 patients, while it was between 30–40% in the rest 24 patients. In addition, echocardiography also picked up regional wall motion abnormalities in 21 (65%), cardiomyopathy in 11 (34%).

Laparoscopic cholecystectomy was performed in all patients (Table 3). The commonest intra-operative problem was episodes of hypertension (21 patients), which always started during peritoneal insufflation, and was controlled by GTN infusion.

On the other hand, 5 patients developed hypotension necessitating immediate desufflation and intravenous infusion of vesopressor agents (noradrenaline and adrenaline). One patient developed tachyarrhythmia during surgery, requiring Amiodarone infusion.

These Intraoperative situations did not require conversion to laparotomy and all the patients were extubated/remove LMA in the operating room. In the post-operative period, 3 patients developed tachyarrhythmia, which required defibrillation in 1 patient.

In the rest 2 patients, there was no haemodynamic compromise. These patients were monitored and the tachycardia subsided spontaneously.

Table-I : *Patient Profile*

Parameter	Number of Patient	Percentage
Mean age	55 years (38-76)	
Male:Female ratio	24:08	
Presence of Medical - Comorbididy	30 patients	
Hypertension	28	87.50
Hypothyroidism	01	3.2
Asthma/ COPD	05	15.62
CRF	21	65.62
Preveous history of cardiac intervension	10	31.25
CABG	03	9.37
PTCA	07	21.87
Pacemaker	01	3.125
NYHA		
Class-I I	24	75.00
Class-III	08	25.00

COPD: chronic obstructive pulmonary disease, CRF: chronic renal failure, CABG: coronary artery bypass grafting, PTCA: percutaneoustranscoronary angioplasty, NYHA: New York Heart Association

Table -II: *Pre-operative cardiac status of 32 patients as per Echocardiographyfindings*

Parameters	No. of patients	Percentage
1. LVEF between 20-30%	08	25
LVEF between 30-40%	24	75
Regional wall motion abnormality	21	65.62
Dilated cardiomyopathy	11	34.37
Bifascicular block	2	6.25
Valvular disease	2	6.25

LVEF: left ventricular ejection fraction

Table -III: *Results of laparoscopiccholecystectomy in 32 patientswith cardiac co-morbidities*

Intra-operative course and complications	Number	percentage	Treatment
Intra-operative complications			
• Persistent HTN	21	65.62	GTN, Desufflation
• Hypotension and	05	15.62	IV pressor support
• Bradycardia	01	3.12	Inj. Atropine
• Tachyarrhythmia	01	3.12	Inj. Esmalol
Post-operative complication			
• Tachyarrhythmia	03	9.37	Beta-blocker

HTN: Hypertension, GTN:Glycerin tri-nitrate

Discussion

This multispecialty hospital is the largest diabetic hospital inBangladesh. More than 40,000 diabetic patients admitted in this hospital per year for their treatment.Amongst these a largenumber of patients are admitted forlaparoscopic cholecystectomy. Most of these patientssuffer from diabetic with cardiac illness or have had some kind ofcardiac intervention.

Haemodynamic and cardiovascular changes of positivepressure CO2 pneumoperitoneum on an anaesthetizedpatient lying in a reverse Trendelenberg position are ofteninterrelated and their individual contribution is difficult todisentangle.

As a generalisation, pneumoperitone umorchestrates a neurohormonal stress response whichincreases systemic vascular resistance, mean arterial bloodpressure and heart rate[14–16]. These factors increase theafterload and myocardial oxygen consumption which arepoorly tolerated by patients with cardiac dysfunction[17]. Elevated intra-abdominal pressure and reverse Trendelenburg position reduce venous return and preload anddecrease cardiac output[18,19]. This combination ofdecreased preload and increased afterload increase cardiacwork load and could precipitate cardiac ischemia orinfarction.

Patients with ischemic heart disease are prone to develop atrial fibrillation, a condition which could beprecipitated by CO_2 pneumoperitoneum[20]. Most of thestudies addressing cardiovascular effects of CO^2 pneumoperitoneumhave been performed in healthy subjects, whoseem to tolerate pneumoperitoneum without untowardproblem [15, 16, 21].

Similar issues have not been studiedunder the setting of randomized trial in patients withcardiac co-morbidities[22]. May be hence, there isconsiderable reticence among surgeons in performinglaparoscopy in patients with compromised heart.

However,laparoscopic cholecystectomy has been successfully performedin small series of 10 -14 patients[23,24,25] with ASA III/IV cardiac dysfunction. To avoid the complicationsof pneumoperitoneum, gasless laparoscopic cholecystectomy(abdominal wall lifting) has been used as an alternativeto laparoscopy in high risk patients[26]. Although abdominal wall lifting is associated with less circulatorychanges and improved post-operative cognitive function,there is increased risk of surgical error[27].

Meticulous history taking and subjective assessment ofpatients undergoing laparoscopic cholecystectomy is animportant aspect of managing such patients. Scoring systemslike ASA physical status, Goldman cardiac Index, CanadianCardiac Scoring system, NYHA functional classification have been devised toassess the risk of intra- and postoperative cardiac complications.

Of these, the NYHA is the most commonly usedgrading system of cardiac dysfunction[12,28]. It isinteresting to note that although the left ventricular ejection (LVEF) on resting transthoracic echocardiography is verycommonly used to assess cardiac function. LVEF is not apart of any of these scoring systems.

Hence there is littlereason to discourage laparoscopic cholecystectomy on thebasis of single

LVEF value. Moreover, assessment of LVEFis operator dependant[29].

Despite these shortcomings,some textbooks continue to lay importance on LVEF, wherea 40% cutoff value is considered safe for surgery[30,31]. As a matter of policy it has been our practice to refer suchpatients for rigorous preoperative assessment by cardiologistand anesthesiologist. Premedication with midazolam helpsreduce anxiety and stress and the heart rate[32]. Preoperativehydration or volume loading is thought to preserve cardiacoutput during laparoscopic surgery[33]. But, in this studyintravenous volume overloading was not practiced; insteadfasting more than 4 hours was avoided and patients wereoperated early in the morning.Due to cardiac dysfunction,intravenous fluid was administered judiciously while oralfluid was commenced as early as 4-5 hours after surgery.

Todiminish the stress on the heart during induction and maintenance of anaesthesia, midazolam, propofol, fentanyl and low dose helothane wereused. These agents cause very little cardiac and circulatorychanges. Tachycardia should be prevented and in 6 (21%) patients, intravenous esmolol, a cardio-specific betablocker,was used to control intraoperative tachycardia.Adequate depth of anaesthesia and pain control also helpsprevent tachycardia. The pressure effects of pneum-operitoneum could bepartially offset by using a low insufflation pressure. Somestudy define 'normal' insufflation pressure as 12–15 mmHgand a 'low' pressure as 5–7 mmHg[22] while a recentreview arbitrarily considered anything less than 12 mmHgas low pressure[34]. Studies in healthy individuals haveshown less pronounced decrease in cardiac index using lowpressure peritoneal insufflation, while the pulmonaryparameters have remained more or less similar in both thegroups[14,35,36]. By and large, the low pressure groupshave also reported less post-operative pain and diminishedanalgesic requirement, but such was always not the case[34].

In patients with cardiac dysfunction, four nonrandomized studies have shown less haemodynamic alterations under low insufflation pressure[6, 37-39].

In thepresent study, a peritoneal pressure of 8 mmHg was usedand this figure was arbitrarily chosen. On occasions thislow intra-peritoneal pressure prevented adequate exposureof the Calot's triangle. In such situations either theperitoneal pressure was temporarily increased to 12 mmHgtill the triangle was safely dissected and cystic duct/ arterywere clipped and then the pressure was decreased to8 mmHg.Rapid insufflation with CO2 stretches theperitoneum and could precipitate cardiac arrhythmia [40].Therefore, a low rate of insufflation of 5 liters/min wasroutinely used in this study.

Conclusion

The present study showed that laparoscopic cholecystectomymay be safely performed in patients with significantcardiac dysfunction. Such patients need proper evaluationin pre anaesthetic check up and by the cardiologists.

A single transthoracicechocardiographic estimation of left ventricularejection fraction should not be given undue importance. Ifconsidered safe to undergo general anaesthesia, suchpatients should not be denied the benefits of laparoscopic cholecystectomy.

Optimization of cardiac status, administrationof balanced anaesthesia and low-pressure pneumoperitoneumare essential steps to ensure patient safety. Thechances of life threatening complications are rare, and inthe eventuality, can be easily managed in a hospital withadequate cardiological support.

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