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# Laparoscopic Cholecystectomy in High Risk Patients

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## 1. Introduction

High risk patients who are candidates for laparoscopic cholecystectomy differ from the patients who have no existing risks and comorbidities in terms of the methods to be used as well as the expected outcomes. In order to recognize the safety of laparoscopic cholecystectomy, different cases of high risk patients undergoing laparoscopic cholecystectomy were gathered which demonstrate their conditions during laparoscopic cholecystectomy. These articles focused on patients with cardiopulmonary diseases, diabetes mellitus, sickle cell diseases, renal diseases, liver cirrhosis, during pregnancy and in the elderly. The results of the different cases showed that laparoscopic cholecystectomy is a safe procedure to be utilized and it is therefore recommended as the treatment of choice, as long as it is done cautiously and skillfully in all the high risk groups. The consequences of this technique including the bile duct injury, influence of pneumoperitoneum on cardiorespiratory system and other complications are outweighed by the benefits that the patients acquire after the surgery.

Patients who are high risk and undergo traditional cholecystectomy carries high morbidity and mortality as compared to laparoscopic cholecystectomy. The introduction of laparoscopic cholecystectomy has decreased the number of contraindications in the past recent years and in which more studies are focused on the constant modifications in terms of the assessed risks as well as the indications for the procedure.<sup>[1]</sup>

Patients who have past or recent medical conditions who are at risk of presenting perioperative complications and those who cannot survive an operation are the ones classified as high risks patients.<sup>[2]</sup> The issue that is always brought up for patients with such conditions is whether the benefits of laparoscopic cholecystectomy offset the risks involved especially with the new methods used in the procedure such as CO<sub>2</sub> insufflation and pneumoperitoneum.<sup>[3]</sup>

There are collated cases which demonstrate the conditions of the high risks patients during laparoscopic cholecystectomy. These articles focused on patients with cardiopulmonary diseases, diabetes mellitus, sickle cell diseases, renal diseases, liver cirrhosis, during pregnancy and in the elderly.

## 2. Patients with cardiopulmonary diseases

Hemodynamic and respiratory effects of the pneumoperitoneum are the most common hazards of surgical intervention in cardiac and pulmonary disease patients. Popken<sup>[1]</sup> stated

that the advantages of laparoscopic cholecystectomy are more rapid recovery of lung function and a shorter stay in hospital. Catani [4] declared that changes in cardiovascular function due to the insufflation are characterized by an immediate decrease in cardiac index and an increase in mean arterial blood pressure and systemic vascular resistance.

## 2.1 Cases

Popken et al [1] published a study regarding patients with cardiopulmonary impairment where they used laparoscopic cholecystectomy in 19 high-risk patients (ASA IV) and 465 patients with a lower operative risk (ASA I-III). The authors state that out of 484 patients, there were 5 percent who suffered intraoperative cardiopulmonary complications. There were three who belonged to the high-risk group (15.8%) and 21 to the lower risk groups (4.5%). There were general postoperative complications that occurred in 14 cases (2.9%). The authors noted that the number of days spent in hospital was 4.96 to 7.6 in average days in the high-risk group versus 2.23 to 4.8 days in groups ASA I-III. They concluded that high-risk patients shows a raise perioperative rate of complications in laparoscopic cholecystectomy but they also stated that it is not basically a contraindication for this operative method.



Tillman et al. [2] also investigated their laparoscopic cholecystectomy cases in 17 patients with severe cardiac dysfunction. They reported that there were three of the 17 patients who required administration of nitroglycerin to maintain the MAP and SVR within the accepted limits while one also required administration of dobutamine to maintain CI. There was no myocardial morbidity or mortality in the perioperative period according to their report. They concluded that laparoscopic cholecystectomy in patients with severe cardiac dysfunction results in significant hemodynamic changes.

## 3. Patients with diabetes mellitus

It has been believed that patients with diabetes mellitus is considered before as a risk factor in patients who undergo laparoscopic cholecystectomy commonly because of symptomatic gallbladder stones.[5] This is due to reports (Chang,M.D)[6] that a high plasma glucose level is associated with a poor neurologic recovery score in patients after cardiopulmonary

resuscitation. Researchers said that even if consciousness is restored, neurologic deficit may remain in hyperglycemic patients. [5] Therefore it is important to maintain an adequate plasma glucose level (120-180 mg/dl) during anesthesia as well as in the pre-operative period.

Specialists agree that in order to achieve strict plasma glucose control, the plasma glucose level is checked and controlled with hypoglycemic agent such as insulin regularly and frequently which helps prevent acute and chronic complications of DM. They said that stress caused by surgery and anesthesia induces hyperglycemia causing higher blood glucose levels in DM patients who underwent surgery than in patients who did not have surgery. [5]

### 3.1 Cases

Bedirli et al. [8] gathered the data for their laparoscopic cholecystectomy cases where there are eight hundred sixty-two patients with symptomatic gallbladder stones who underwent laparoscopic cholecystectomy. They took into consideration the age, sex, risk classification of the American Society of Anesthesiologists (ASA), laboratory tests, operative records, morbidity and length of hospital stay for each patient. They noted that almost half of their cholecystectomies which comprised 111 patients were performed as acute surgery due to cholecystitis. There were conversions to open surgery which were required in 16% of the diabetic patients undergoing LC. They concluded that when feasible, LC was a safe procedure in diabetes.



Paajanen et al [9] studied 2,548 consecutive patients (1,581 LC, 967 OC) with symptomatic gallstones who underwent cholecystectomy. They summed up that from 1995 and 2008, they operated 227 patients with diabetes 45 of these patients had type 1 diabetes. They made a comparison with the preoperative data and the operative outcome of the diabetic patients who underwent laparoscopic cholecystectomy and open cholecystectomy. They had observed that more complications occur in the open cholecystectomy group than in the laparoscopic cholecystectomy group. Upon their analysis they stated that comorbidities of diabetes were associated with an elevated risk for complications but obesity or acute surgery was not independently associated with postoperative complications. The authors concluded that laparoscopic cholecystectomy is a safe procedure in diabetic patient as compared to open cholecystectomy where there is a significant reduction in operative risks and complications.

#### 4. Patients with sickle cell diseases

Among the genetic disorders, sickle cell disease is the most common around the world. People who are affected are at an increased risk of developing pigmented gallstones [10] and it is said that this risk increases with age. Perioperative and postoperative complications which are mainly vaso-occlusive crises (VOC) may occur as a result of surgeries for symptomatic stones. Minimal risks have been associated with the introduction laparoscopic cholecystectomy because of its advantages over the traditional open surgeries.

##### 4.1 Cases

It is believed that minimally invasive therapy can reduce morbidity and mortality in sickle cell disease patients. The safety of laparoscopic cholecystectomy in such patients has already been recognized. Rachid et al [10] reported the results of their experience on laparoscopic cholecystectomy in sickle cell disease patients in Niger, which is included in the sickle cell belt. Their study covered 45 months and included 47 patients operated by the same surgeon. The average age was 22.4 years (range: 11 to 46 years) and eleven (23.4%) of them were aged less than 15 years. The types of sickle cell disease found were 37 SS, 2 SC, 1 S beta-thalassemia and 7 AS. The indications for their surgeries were biliary colic in 29 cases (61.7%) and acute cholecystitis in 18 cases (38.3%). Their mean operative time was 64 minutes. Reports from the authors states that there were conversions to open cholecystectomy in 2 cases (4.2 %) for non recognition of Calot's triangle structures. They reported four cases of postoperative complications of vaso-occlusive crisis and one case of acute chest syndrome. Their mean postoperative hospital stay was 3.5days (range: 1 to 9 days). There was no mortality encountered. The authors concluded that laparoscopic cholecystectomy is a safe procedure in sickle cell patients and that it should be a multidisciplinary approach and involve the haematologist, anaesthesiologist and a surgeon.



Haberkem et al [12] studied a group of 364 patients who underwent cholecystectomy. There were ninety-eight percent of their patients who had symptomatic cholelithiasis. Their total perioperative morbidity was 39% and they reported that while total morbidity is not affected by preoperative transfusion, the incidence of specific sickle cell events is higher in those patients who were not transfused preoperatively than in those who were. Laparoscopic cholecystectomy was accompanied by shorter hospitalization time (6.4 days)



than the open cholecystectomy (9.8 days) and noted that perioperative outcomes were the same with both techniques. The authors concluded that conservative preoperative transfusion and use of the laparoscopic technique are necessary for patients with sickle cell disease who will be undergoing cholecystectomy to prevent further complications.

## 5. Patients with renal diseases

Management of gallstones in renal transplant patients was always questioned because of the related complications. It has been found out that patients with renal disease have a higher incidence of coronary artery disease (CAD) and peripheral vascular disease (PVD) compared to the general population because they have the traditional risk factors for CAD such as advanced age, diabetes, hypertension and lipid disorders as well as a high prevalence of such as hyperhomocysteinemia, abnormal calcium phosphate metabolism, anemia, increased oxidative stress and uremic toxins.<sup>[27]</sup>

### 5.1 Cases

Ekici et al <sup>[25]</sup> conducted a study where they assessed laparoscopic cholecystectomy (LC) in patients with end-stage renal disease treated with continuous ambulatory peritoneal dialysis. There were eleven patients receiving peritoneal dialysis treatment and 33 patients without end-stage renal disease who had undergone an elective LC were compared. They reviewed all their medical records and the laboratory values as well as the outcomes and results. Their peritoneal dialysis group showed a higher frequency of associated disease and previous abdominal surgery, a lower hemoglobin and platelet count and elevated alkaline phosphatase, blood urea nitrogen and creatinine values. There was one procedure in each group that was converted to an open cholecystectomy. There were no other catheter-related complications that occurred. The authors concluded that laparoscopic cholecystectomy may be performed with low complication rates in patients undergoing continuous ambulatory peritoneal dialysis with an experienced team.



Banli et al <sup>[26]</sup> evaluated the outcomes of laparoscopic cholecystectomy in renal transplant patients with symptomatic gallstone disease. They reviewed the records of 155 kidney transplant patients, including 16 patients who underwent laparoscopic cholecystectomy. They found out that the shortest interval time between transplantation and cholecystectomy was 2 years. Surgical morbidity were seen in two of the patients with no mortality and no

graft loss. They concluded that laparoscopic cholecystectomy can be performed safely with low morbidity in renal transplant patients who have symptomatic gallstone disease.

## 6. Patients with cirrhotic diseases

Liver diseases are always considered risk factors in operations due to increase risks of complications and sometimes can even be the cause of death. Liver decompensation is also one reason why clinicians are hesitant to recommend surgeries due to the possible occurrence of abnormal clearance of proteins, abnormal excretion, ascites and portal hypertension.<sup>[11]</sup>

There are also factors being considered such as the patients Child-Pugh score, the length and extent of the surgery as well as postoperative complications.<sup>[23]</sup> The Child-Pugh score is used to evaluate and assess the condition of a patient with liver disease as well as predict mortality during surgery. Nowadays it is also used to establish the prognosis and the required treatment for the disease.<sup>[23]</sup>

Another recent assessment tool is the Model for End-Stage Liver Disease, or MELD, a scoring system for assessing the severity of chronic liver disease. This system uses the patient's values for serum bilirubin, serum creatinine, and the international normalized ratio for prothrombin time (INR) to predict the patient's survival after surgery.<sup>[11]</sup>

### 6.1 Cases

Cucinotta et al<sup>[7]</sup> accumulated the records of 22 laparoscopic cholecystectomies which they performed in patients with cirrhosis Child-Pugh A and B. These data were gathered from January 1995 to July 2001. There was no death reported and the average duration of the surgeries were 115 minutes and were noted that they were shorter than the usual open cholecystectomy. They also stated that blood transfusion was not required in all the surgeries and that the intraoperative complications that occurred were liver bed bleeding. They also noted some postoperative morbidities such as hemorrhage, wound complications, cardiopulmonary complications and intraabdominal collections in 36% of the patients but reported that they were all controlled. They observed the length of hospital stay in patients with an average of 4 days. The authors concluded that with laparoscopic cholecystectomy having lower morbidity, shorter operative time and with reduced hospital stay, it can be safely done in patients with cirrhosis Child-Pugh A and B who are carefully selected and screened as to their need for surgery.

Another study was also done by Delis et al<sup>[15]</sup> from January 1995 to July 2008 where they performed 220 laparoscopic cholecystectomies in patients Child-Pugh class A and B patients with MELD scores ranging from 8 to 27. Their indications for the said operations were symptomatic gallbladder disease and cholecystitis. They reported that no deaths occurred and observed that there were postoperative morbidities that occurred such as hemorrhage, wound complications and intra-abdominal collections but they were controlled. They stated that intraoperative difficulties due to liver bed bleeding were experienced in 19 patients. There was a necessity to convert 12 of their cases to open cholecystectomy. Their median operative time was 95 minutes while their median hospital stay was 4 days. They reported that patients with preoperative MELD scores above 13 showed a tendency for higher complication rates postoperatively. The authors concluded that laparoscopic cholecystectomy can be performed safely in selected patients with cirrhosis Child-Pugh A and B and symptomatic cholelithiasis with acceptable morbidity.

Leone et al <sup>[16]</sup> presented their cases between January 1994 and December 2000 where there were 1,100 laparoscopic cholecystectomies for symptomatic gallbladder diseases. They reported that there were 24 cirrhotic patients who had well-compensated cirrhosis (Child's class A or B). The authors reported that there were no operative mortality and the postoperative complication rates were 20.8%. They estimated that the intraoperative blood loss was 37.08 ml in average. Their average hospital stay 3.61 days. The authors concluded that laparoscopic cholecystectomy in patients with compensated cirrhosis is safe and should be the treatment of choice for these patients. They further stated that laparotomy should be applied only if the surgeon considers the operation inadequate to be continued laparoscopically.

## 7. Patients who are pregnant

Diseases in the abdomen requiring surgical intervention during pregnancy present unique challenges to their diagnosis and management <sup>[17]</sup>. These are said to be due to the changes in physiology and abdominal anatomy characteristic of pregnancy. These changes make laparoscopic surgery technically more difficult, the obstetrician must determine the status of pregnancy such as gestational age, viability and inform the patient about the risks related to pregnancy and surgery itself <sup>[18]</sup>.

There are several mechanisms that have been proposed by specialists for increased fetal morbidity and mortality associated with laparoscopic surgery during pregnancy including direct uterine trauma, fetal trauma, intraamniotic CO<sub>2</sub> insufflation, trauma to maternal abdominal organs and vessels, decreased uterine blood flow and oxygen delivery, teratogenic effects of anesthetic drugs, fetal acidosis due to CO<sub>2</sub> pneumoperitoneum, adverse effects of anesthesia on maternal hemodynamic and acid-base balance, increased risk of thromboembolic disease, the effect of underlying abdominal pathology, manipulation during surgery and effects of postoperative medications <sup>[18,20]</sup>. Therefore laparoscopic cholecystectomy has been used cautiously in pregnant women. This is due to the possible mechanical problems related to the pregnant uterus and the other is fear of fetal injury resulting from instrumentation or the pneumoperitoneum.

### 7.1 Cases

To assess the effects of laparoscopic cholecystectomy on both the mother and the unborn fetus, Abuabara et al <sup>[19]</sup> reviewed their surgical experience over a 5-year period where 22 patients ranging from 17 to 31 years underwent laparoscopic cholecystectomy during pregnancy. They noted that the gestational ages ranged from 5 to 31 weeks where there are two patients who are in their first trimester, 16 in the second and four in the third. Their indications for surgery were persistent nausea, vomiting, pain, and inability to eat in 17 patients, acute cholecystitis in three and choledocholithiasis in two. The surgeons established pneumoperitoneum in all patients and their results were all 22 patients survived the surgical procedure without complications and there were no fetal deaths or premature births related to the procedure. The authors concluded that laparoscopic cholecystectomy during pregnancy is safe for both the mother and the unborn fetus and if at all possible, when laparoscopic cholecystectomy is indicated, it should be performed either in the second trimester or early in the third.

Wishner et al <sup>[21]</sup>, members of the Norfolk Surgical Group, gathered their data for the laparoscopic cholecystectomy cases from May 1991 to June 1994 where they performed the



operations on 1,300 patients. There were six of these patients who were operated on during pregnancy. They were able to successfully perform the operation on all the six patients and observed that the overall course of the operation is the same with non-pregnant patients. They reported that there were no significant complications to either the patient or the fetus. It was reported later that all the six patients delivered healthy babies and noted no signs of complications. The authors concluded that laparoscopic cholecystectomy can be performed safely in pregnant patients and that it should be considered in any patient who presents with symptomatic cholelithiasis during pregnancy.

## 8. Elderly patients

Age is one of the critical factors affecting the mortality and morbidity rates after open cholecystectomy for both acute and chronic cholecystitis [2, 3]. Several series of open cholecystectomy [4, 5] report death as a complication occurring almost exclusively in patients over 60 years of age [6]. Smith and Max [7] found that the morbidity-mortality rate after open cholecystectomy was 25% for patients aged 60-69 as opposed to 50% for patients over 70.

Ageing patients with symptomatic cholelithiasis frequently have associated medical disorders. They may be at higher risk of postoperative complications. Evaluation of the results of the laparoscopic approach in the aged would allow patients and surgeons to make decisions on the most appropriate treatment for symptomatic cholelithiasis.

### 8.1 Case

Brunt et al<sup>[22]</sup> gathered their laparoscopic data for 421 patients from 1989 to 1999 which were extremely elderly or older than 80 years to determine whether extremely elderly patients, age 80 years or older, were at higher risk for adverse outcomes from laparoscopic cholecystectomy than patients younger than 80 years. The patients were divided into two groups: group 1 (age 65-79 years; n = 351) and group 2 (age, 80-95 years; n = 70). The authors noted that the advanced age (group 2) was associated with a higher mean American Society of Anesthesiology (ASA) class and a greater incidence of common bile duct stones, as compared with those of younger age (group 1). Mean operative times in group 2 were 45-106 minutes as compared with 38 to 96 minutes in group 1, a difference that is not significant. The authors noted that the extremely elderly group had a four times higher rate of conversion to open cholecystectomy and a longer mean postoperative hospital stay of 1.4 to 2.1 days. They also stated that Grades 1 and 2 complications were more common in group 2. They reported that one patient in group 1 had a myocardial infarction 13 days postoperatively, and two deaths occurred in the extremely elderly group within 30 days postoperatively. The authors concluded that laparoscopic cholecystectomy in the extremely elderly is associated with more complications and a higher rate of conversion to open cholecystectomy than in elderly individuals younger than 80 years. The greater chance of encountering a severely inflamed or scarred gallbladder and common bile duct stones as well as increasing comorbidities likely account for these differences in outcome.

Mayol et al<sup>[24]</sup> gathered the outcome of all their laparoscopic cholecystectomy patients between 60 and 70 years of age and patients over 70 who underwent laparoscopic cholecystectomy for symptomatic non-malignant gallbladder disease. They found out that the operative time and conversion rates were similar with both groups. They noted that the overall morbidity rate was 14.5% and there was no perioperative mortality that occurred. There was a recurrent biliary surgery done in two patients from the above 70 group. There were also postoperative endoscopic retrograde cholangiography and sphincterotomy that

was done in four patients from the below 70 group. They also found out that the mean postoperative stay was longer for older patients above 70 years of age. The authors concluded that simple laparoscopic cholecystectomy is safe in the aged even for patients over 70. They stated that this procedure is associated with a short hospital stay and low rates of re-admission and recurrent biliary surgery.

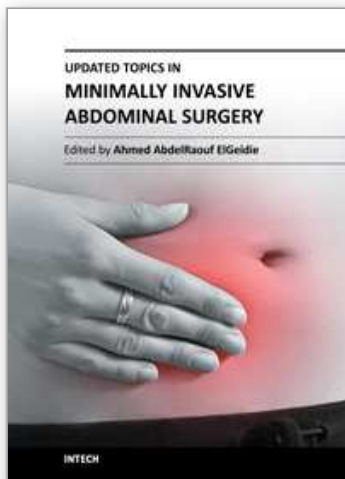
## 9. Conclusion

With the success of laparoscopic cholecystectomy on different high risk patients, it is therefore recommended as the treatment of choice. The consequences of this technique including the bile duct injury, influence of pneumoperitoneum on cardiorespiratory system and other complications are outweighed by the benefits that the patients acquire after the surgery and these consequences can be prevented by performing the operation cautiously and skillfully in all the high risk patient groups.

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## **Updated Topics in Minimally Invasive Abdominal Surgery**

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