

Laparoscopic Cholecystectomy (LC) and the Risk Factors in the Conversion to Open Cholecystectomy (OC) Surgery: Jordan Statistical Review

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Abstract

This study aimed at exploring the risk factors in the conversion from laparoscopic cholecystectomy (LC) to open cholecystectomy (OC) Surgery, and overview the Jordanian statistics for patients over the year 2016 in the Jordanian hospitals. Results show that male gender with symptomatic cholelithiasis was associated with higher conversion rates. And results also showed that the age (>65 years) to be a risk factor for increased perioperative morbidity and conversion rates because of associated acute cholecystitis. Laparoscopic cholecystectomy is a safe procedure in patients, with no increased risk of complications compared with the open procedure. The recovery is faster and the hospital stay, shorter.

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This research was conducted with joint efforts of all the authors, Dr. Jaber Hathloul Alshammari, Dr. Renad Anas Khashogji and Dr. Ahmed Hussain Albaqshi as main authors. And Dr. Hassan abdullah alwosibai, Dr. Ahmed Hussain Alalawi, Dr. Jumanah Turki Albarakati and Dr. Maha Hamed Altowairqi as co-authors.

1.1 Introduction

There are no effective medical treatments that will rid the body of gallstones. Pain killers and antibiotics can treat the symptoms of some acute attacks and a few patients will be lucky enough to have no further problems. However, the majority of patients will go on to suffer repeatedly. For those patients who have had acute pancreatitis due to gallstones, open surgery is recommend.

As a standard treatment procedure for acute cholecystitis; laparoscopic cholecystectomy (LC) has been linked to a lower complication rate and shorter postoperative hospital stay compared with open cholecystectomy (OC). Performing early cholecystectomy on patients admitted for acute cholecystitis is preferable to postponing the operation to be performed when the acute phase is over, since an early procedure has been recognized to shorten postoperative hospital stay and lower hospital care expenses (Gurusamy, Samraj, Gluud, Wilson & Davidson, 2010).

The first successful laparoscopic cholecystectomy (LC) was done in 1985 by Eric Muhe. Two years later, Philip Mauret improved the method, over the past two decades, laparoscopic cholecystectomy (LC) has become gold standard for the surgical treatment of gallbladder disease. The advantages of LC over open surgery are a shorter hospital stay, less postoperative pain, faster recovery, better cosmoses (Reynolds, 2001).

The complications named as the risk factors encountered during LC are numerous: some that are specific to this unique technique and some that are common to laparoscopic surgery in general. These include complications related to anesthesia; complications related to peritoneal access (e.g., vascular injuries, visceral injuries, and port-site hernia formation); complication related to pneumoperitoneum (e.g., cardiac complication, pulmonary complications, and gas embolism); and complications related to thrombo-coagulation. Specific complication of LC are hemorrhage, gall bladder perforation, bile leakage, bile duct injury, and perihepatic collection), and others such as external biliary fistula, wound sepsis, hematoma and foreign body inclusions. Some of these complications and several other factors can necessitate the conversion from LC to open cholecystectomy (Shamiyeh & Wayand, 2004).

The conversion from LC to open cholecystectomy results in a significant change in out-come for the patient because of the higher rate of postoperative complications and the longer hospital stay in addition to the effect and the long term sequel of the cause of conversion itself as in bile duct injury (Sicklick, Camp, Lillemoe, Melton, Yeo & Campbel, 2005).

Conversion to open cholecystectomy is occasionally necessary to avoid or repair injury, delineate confusing anatomic relationships, or treat associated conditions (Tayeb, Raza, Khan & Azami, 2005).

Gallbladder disease is among the leading causes for hospital admission for acute abdomen among adults and the most common indication for abdominal surgery in the elderly (Ukkonen, Kivivuori, Rantanen & Paajanen, 2015).

In situations when LC is unsafe the surgeon might have to convert to an open procedure. The risk of conversion is higher in LC for open cholecystectomy (OC) than it is in an elective procedure. The risk factors of conversion for patients undergoing LC for open cholecystectomy (OC) are linked to (Wevers, Westreenen & Patijn, 2013):

1- Gender,
2- Age,
3- Previous endoscopic retrograde cholangiopancreatography (ERCP),
4- Elevated C-reactive protein (CRP),
5- White blood cell count (WBCC) and

Conservative treatment with antibiotics and delaying the procedure to be performed after the acute phase has shown no change in conversion and complication rates. Patients who have had to undergo conversion have had more complications, which have led to further operations and a longer postoperative hospital stay (Dominguez, Rivera, Bermudez & Herrera, 2011).

1.2 Problem statement

Acute cholecystitis is a common cause of abdominal pain and unless treated promptly, patients may develop complications such as gangrenous, perforated, or emphysematous cholecystitis. Because of the increased morbidity and mortality of complicated cholecystitis, early diagnosis and treatment are essential for optimal patient care (Charalel, Jeffrey & Shin, 2011).

There is considerable controversy over the timing of laparoscopic cholecystectomy in acute cholecystitis. In the era of open cholecystectomy, early surgery (within 7 days of onset of symptoms) had no increased morbidity or mortality over delayed surgery (at least 6 weeks after symptoms settled). Delaying surgery increases the risk factors of further gallstone-related complications. With laparoscopic cholecystectomy, there are concerns about

higher morbidity rates in an emergency procedure and the higher conversion rate to an open procedure during the acute phase. The main reason for conversion in early laparoscopic cholecystectomy (ELC) is inflammation obscuring the view of Calot's triangle, whereas in delayed laparoscopic cholecystectomy (DLC) it is fibrotic adhesions. Severe inflammation and fibrotic adhesions are associated with bile duct injury (Senapati, Bhattarcharya, Harinath & Ammori, 2003).

The problem statement of this study lies in exploring the risk factors in the conversion from laparoscopic cholecystectomy (LC) to open cholecystectomy (OC) Surgery, and overview the Jordanian statistics for patients over the year 2016 in the Jordanian hospitals. Besides analyzing the risk factors of conversion for patients undergoing LC to open cholecystectomy (OC) linked to gender, age, previous endoscopic retrograde cholangiopancreatography (ERCP), a non-palpable gallbladder, elevated C-reactive protein (CRP) and white blood cell count (WBCC).

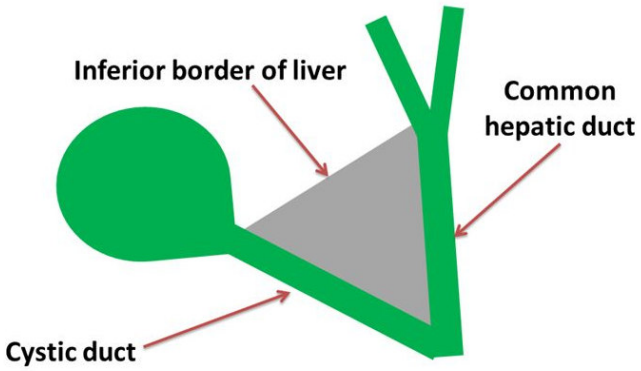


Figure (1): Calot's triangle

1.3 Laparoscopic Cholecystectomy (LC)

Laparoscopic cholecystectomy (LC) should be the procedure of choice in patients with symptomatic gallstone disease (Psaila, Agrawal, Fountain, Whitfield, Murgatroyd, Dunsire & Patel, 2008).

Most patients with gallstones or a diseased gall bladder are advised to undergo elective laparoscopic cholecystectomy. Elderly patients with underlying medical conditions and minimal gall bladder symptoms are managed without intervention. Several long-term studies have shown a significant risk of gallstone complications developing in patients who have not received treatment (Gurusamy, Samraj, Gluud, Wilson & Davidson, 2010).

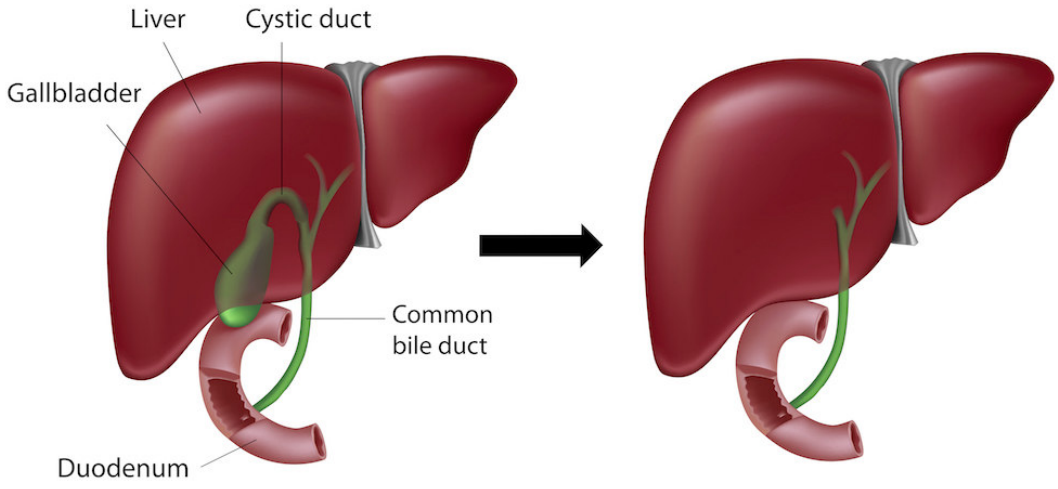
Cholecystectomy is one of the most common digestive tract diseases and constitutes an important health problem in developing countries. The statistics of the Jordanian Ministry of Health show that adult Jordanian population having gallstones are shown in table (1) below:

Table (1): Jordanian Ministry of Health statistics

Gallstones Disease	Percentage
Over all percentage of the total population	10%-15%
Becoming symptomatic each year	1%-4%
Annually performed cholecystectomies in Jordan	6000 patient
Annually performed laparoscopic cholecystectomies in Jordan	3300 patient

The introduction of the laparoscopic technique in 1985, first made by Mühe was an important factor for the large increase in the cholecystectomy, since it represented a less invasive technique, generated better esthetic result and provided a lower surgical risk compared to the conventional procedure. Dubois and Barthelot introduced in 1982, minimally invasive technique for conventional cholecystectomy, the minilaparotomy cholecystectomy, and Tyagi et al, in 1994, described a new technique for minimally invasive cholecystectomy, and this has recently challenged the role of laparoscopic cholecystectomy (CASTRO, AKERMAN, MUNHOZ, SACRAMENTO, MAZZURANA & Alvarez, 2014).

The procedure of laparoscopic cholecystectomy involves removing the gallbladder as shown in figure (2), which is a small organ that stores bile and helps with digestion; and it's not necessary for digestive function. Laparoscopic surgery is done using a scope and hollow tube(s) called ports. These are inserted through small cuts in the abdomen. A scope is a thin, lighted instrument with a camera attached. It lets the surgeon see inside the abdomen. The surgeon can pass tools through the ports. Carbon dioxide gas is pumped into the abdomen. This helps the surgeon see inside the abdomen. It also gives more room to work.



Figurer (2): Before and after laparoscopic cholecystectomy

1.4 Open Cholecystectomy (OC)

Since its introduction in the late 1980s, laparoscopic cholecystectomy (LC) has all but replaced open cholecystectomy (OC). The laparoscopic approach, used in 75% to 95% of cases, is now referred to widely as the "gold standard" for management of symptomatic gallstone disease. There is overwhelming evidence that LC

offers patients less pain, shorter hospitalization, and faster recovery. The decreasing frequency of open cholecystectomy (OC) in clinical practice is, of course, reflected in a reduction in training opportunities. Nonetheless, the procedure remains the fallback gold standard in the operating theater and the courtroom with respect to safety and success, particularly in complicated cases.

Open cholecystectomy is a surgery in which the abdomen is opened to permit cholecystectomy (removal of the gallbladder). This operation has been employed for over 100 years and is a safe and effective method for treating symptomatic gallstones, ones that are causing significant symptoms. At surgery, direct visualization and palpation of the gallbladder, bile duct, cystic duct, and blood vessels allow safe and accurate dissection and removal of the gallbladder. Intra-operative cholangiography has been variably used as an adjunct to this operation. The rate of common bile duct exploration for choledocholithiasis (gallstones in the bile duct) varies from 3% in series of patients having elective operations to 21% in series that include all patients. Major complications of open cholecystectomy are infrequent and include common duct injury, bleeding, biloma, and infections. Open cholecystectomy is the standard against which other treatments must be compared and remains a safe surgical alternative (Kanaan, Murayama, Merriam, Dawes, Prystowsky, Rege & Joehl, 2002).

Open cholecystectomy (OC) is thus reserved principally for cases where laparoscopic surgery fails with the resulting paradox that fewer surgeons have experience of the technique required for the most difficult cases (Visser, Parks & Garden, 2008).

1.5 Reasons for converting from (LC) to (OC)

Laparoscopic cholecystectomy has been especially popular because it is less invasive and has shorter hospital stays and a shorter timeframe until return to normal activities than is associated with open cholecystectomy (Hannan, Imperato, Nenner & Starr, 1999).

Jordanian statistics as shown in table (2) show that patients having open conversion were:

Table (2): Characteristics of the converted to OC patients in Jordan

Patients converted to OC	Patients not converted to OC
Older	Younger
Mostly males	Mostly females
Greater leukocyte count	Less leukocyte count

Jordanian statistics as shown in table (3) also show the percentages of the reasons to for conversion to open cholecystectomy:

Table (3): Percentages of the reasons to for conversion to open cholecystectomy in Jordan

Reason	Percentage
Difficult to define anatomy	69.1%
Suspicion of CBD injury	7.7%
Duodenal injury	2.8%
Cystic artery bleeding	10.8%
Cystic duct injury	5.4%
Suspicion of gall bladder cancer	4.2%
Total	100%

And figure (3) shows the histogram percentage distributions of the reasons for conversion to open cholecystectomy in Jordan.

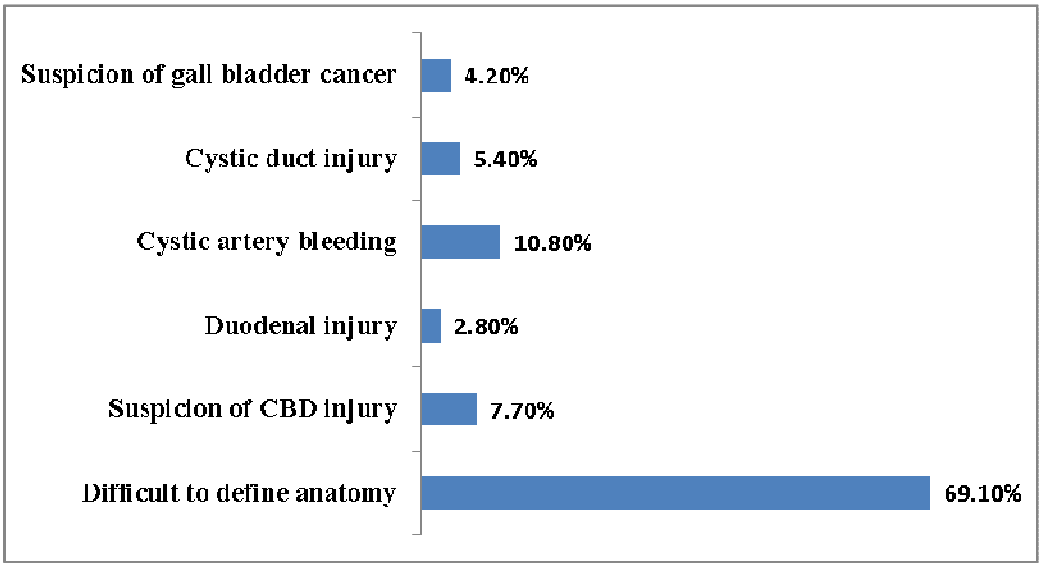


Figure (3): Percentage distributions of the reasons for conversion to open cholecystectomy in Jordan.

1,6 Risk factors in the conversion to open cholecystectomy surgery

The risk factors associated with the conversion to open cholecystectomy (OC) are linked to:

1.6.1 Gender

Jordanian statics show that male gender with symptomatic cholelithiasis was associated with higher conversion rates, and the conversion rate was 2.9% for women and 7.5% for men as shown in figure (4).

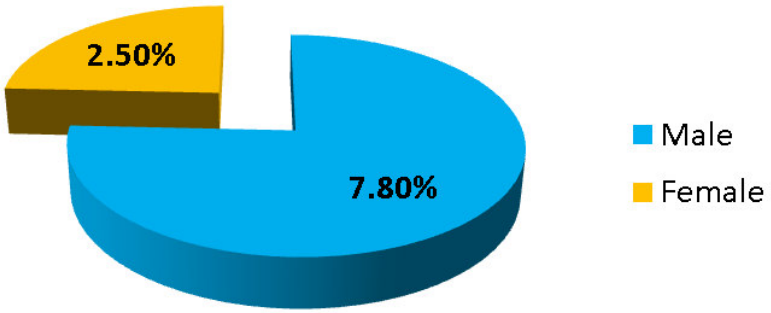


Figure (4): Jordanian statics of gender risk factor

1.6.2 Age

Many studies have shown age (>65 years) to be a risk factor for increased perioperative morbidity and conversion rates because of associated acute cholecystitis (Bazoua & Tilston, 2014).

1.6.3 Previous endoscopic retrograde cholangiopancreatography (ERCP)

ERCP provides detailed and accurate information of the pancreaticobiliary system in cases which cannot be diagnosed by endoscopic ultrasound. It also provides a less invasive option than open surgery for the management of several pancreatic conditions. ERCP has evolved from a purely diagnostic tool to a predominantly therapeutic procedure.

The role and timing of endoscopic retrograde cholangiopancreatography (ERCP) in the management of gallstone pancreatitis has been a subject of much debate over the past few years.

There is a growing consensus among gastroenterologists that ERCP should be reserved principally, if not solely, for patients in whom therapeutic intervention is likely, because the procedure carries a morbidity of 5% to 10% and a mortality of 0.1% to 0.5%. ERCP shares the risks associated with all endoscopic techniques, as well as having complications particular to this procedure. Risks specific to instrumentation of the pancreaticobiliary system include pancreatitis, cholangitis, bleeding and retroduodenal perforation (Byrne, 2006).

1.6.4 Elevated C-reactive protein (CRP)

C-reactive protein (CRP), an acute-phase protein, is produced in hepatocytes. CRP is a phylogenetically highly conserved plasma protein that participates in the systemic response to inflammation. Its plasma concentration increases during inflammatory states, a characteristic that has long been employed for clinical purposes (Shen, Zhang, Zhang & Ji, 2009).

Elevated CRP level is an independent predictor for conversion. Surgery for acute cholecystitis in patients with CRP level >165 mg/L should be considered as high risk for conversion.

1.6.5 White blood cell count (WBCC)

Patients with elevated total white blood cell count upon the Jordanian statics were found to have a higher risk of conversion. Also, the conversion from laparoscopic to open cholecystectomy in acute cholecystitis patients was associated with greater white blood cell count.

***1.7* Comparison between Laparoscopic Cholecystectomy (LC) and Open Cholecystectomy (OC) Surgery**

Between January 1, 2016 and December 31, 2016 in the Jordanian hospitals, 120 elective cholecystectomy without cholangiography were performed in patients for symptomatic cholelithiasis, of which 51 (42.5%) corresponded to open cholecystectomy (OC) and 69 (57.5%), laparoscopic cholecystectomy (LC). And the records show that the conversion from laparoscopic surgery to open one was necessary in two (2.9%) cases, one relating to the difficulty in identifying the Calot triangle structures, and the second converted at the end of the procedure, after removal of the gallbladder, to carry out an of an intestinal puncture lesion perceived at the end of the procedure.

Records and statistics also show other differences; as illustrated in table (4) below:

Table (4): Differences between Laparoscopic Cholecystectomy (LC) and Open Cholecystectomy (OC)

Differences	Laparoscopic Cholecystectomy (LC)	Open Cholecystectomy (OC)
Length of stay	Shorter, with the averaging of 2.23±0.8 days	Longer, with the averaging of 2.95±1.5 days
Postoperative complications	Identified in eleven patients (10%) after LC	Identified in seven patients (5.8%) patients after OC

Records also showed these percentages of complications for the surveyed 120 patients, as shown in table (5) below:

Table (5): Complications percentages for Laparoscopic Cholecystectomy (LC) and Open Cholecystectomy (OC)

Complications	Laparoscopic Cholecystectomy (LC)	Open Cholecystectomy (OC)
Wound seroma	5 (4.16%)	3 (2.5%)
Incisional hernia	6 (5%)	4 (3.33%)
Wound hematoma	2 (1.6%))	2 (1.6%))
Surgical site infection	1 (0.8%)	1 (0.8%)
Cystic duct lesion	0 (0%)	2 (1.6%)
Desaturation	0 (0%)	1 (0.8%)
Small bowel lesion	0 (0%)	2 (1.6%))

In conclusion, laparoscopic cholecystectomy is a safe procedure in patients, with no increased risk of complications compared with the open procedure. The recovery is faster and the hospital stay, shorter. It is important the correctly assess the cardiovascular surgical risk, since this group of patients have lower vital reserve, being more sensitive to surgical trauma. In the era of laparoscopic surgery, with increasing experience of surgeons and the advent of new technologies, old age is not a contraindication for LC, and there are no major complications of this surgery when electively performed.

References

Bazoua, G., & Tilston, M. P. (2014). Male gender impact on the outcome of laparoscopic cholecystectomy. *JSLS: Journal of the Society of Laparoendoscopic Surgeons*, *18*(1), 50.

Byrne, M. F. (2006). Gallstone pancreatitis–who really needs an ERCP?. Canadian Journal of Gastroenterology and Hepatology, 20(1), 15-17.

CASTRO, P. M. V., AKERMAN, D., MUNHOZ, C. B., SACRAMENTO, I. D., MAZZURANA, M., & Alvarez, G. A. (2014). Laparoscopic cholecystectomy versus minilaparotomy in cholelithiasis: systematic review and meta-analysis. *ABCD. Arquivos Brasileiros de Cirurgia Digestiva (São Paulo)*, *27*(2), 148-153.

Charalel, R. A. Jeffrey, R. B. and Shin L. K., "Complicated cholecystitis: the complementary roles of sonography and computed tomography," Ultrasound Quarterly, vol. 27, no. 3, pp. 161–170, 2011.

Dominguez LC, Rivera A, Bermudez C, Herrera W. Analysis of factors for conversion of laparoscopic to open cholecystectomy: a prospective study of 703 patients with acute cholecystitis. Cir Esp. 2011;89:300–6.

Gurusamy K, Samraj K, Gluud C, Wilson E, Davidson BR. Meta-analysis of randomized controlled trials on the safety and effectiveness of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Br J Surg. 2010;97:141–50.

Gurusamy, K., Samraj, K., Gluud, C., Wilson, E., & Davidson, B. R. (2010). Meta-analysis of randomized controlled trials on the safety and effectiveness of early versus delayed laparoscopic cholecystectomy

for acute cholecystitis. British journal of surgery, 97(2), 141-150.

Hannan, E. L., Imperato, P. J., Nenner, R. P., & Starr, H. (1999). Laparoscopic and open cholecystectomy in New York State: mortality, complications, and choice of procedure. Surgery, 125(2), 223-231.

Kanaan, S. A., Murayama, K. M., Merriam, L. T., Dawes, L. G., Prystowsky, J. B., Rege, R. V., & Joehl, R. J. (2002). Risk factors for conversion of laparoscopic to open cholecystectomy. Journal of Surgical Research, 106(1), 20-24.

Psaila, J., Agrawal, S., Fountain, U., Whitfield, T., Murgatroyd, B., Dunsire, M. F., ... & Patel, A. G. (2008). Day-surgery laparoscopic cholecystectomy: factors influencing same-day discharge. World journal of surgery, 32(1), 76-81.

Reynolds, W. (2001) The First Laparoscopic Cholecystectomy. JSLS, 5, 89-94.

Senapati PS, Bhattarcharya D, Harinath G, Ammori BJ. A survey of the timing and approach to the surgical management of cholelithiasis in patients with acute biliary pancreatitis and acute cholecystitis in the UK. Ann R Coll Surg Engl 2003; **85**: 306–312.

Shamiyeh, A. and Wayand, W. (2004) Laparoscopic Cholecystectomy: Early and Late Complications and Their Treatment. Langenbeck's Archives of Surgery, 389, 164-171.

Shen, H., Zhang, N., Zhang, X., & Ji, W. (2009). C-reactive protein levels after 4 types of arthroplasty. *Acta orthopaedica*, *80*(3), 330-333.

Sicklick, J.K., Camp, M.S., Lillemoe, K.D., Melton, G.B., Yeo, C.J., Campbel, K.A., et al. (2005) Surgical Management of Bile Duct Injuries Sustained during Laparoscopic Cholecystectomy. Annals of Surgery, 241, 786-795.

Tayeb, M., Raza, S.A., Khan, M.R. and Azami, R. (2005) Conversion from Laparoscopic to Open Cholecystectomy: 226 Multivariate Analysis of Preoperative Risk Factors. Journal of Postgraduate Medicine, 51, 234-238.

Ukkonen M, Kivivuori A, Rantanen T, Paajanen H. Emergency Abdominal Operations in the Elderly: A Multivariate Regression Analysis of 430 Consecutive Patients with Acute Abdomen. World J Surg. 2015;39:2854–61.

Visser, B. C., Parks, R. W., & Garden, O. J. (2008). Open cholecystectomy in the laparoendoscopic era. The American Journal of Surgery, 195(1), 108-114.

Wevers KP, van Westreenen HL, Patijn GA. Laparoscopic cholecystectomy in acute cholecystitis: C-reactive protein level combined with age predicts conversion. Surg Laparosc Endosc Percutan Tech. 2013;23:163–6.