Republic of Yemen
Ministry of Higher Education
and Scientific Research
21 SEPTEMBER UNIVERSITY
FACULTY OF MEDICINE

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
جامعة ٢١ سبتمبر للعلوم الطبية والتطبيقية

CAUSES AND INCIDENCES OF LAPAROSCOPIC CONVERSION OF CHOLECYSTECTOMY IN AL-THAWRA MODERN GENERAL HOSPITAL SANA'A, YEMEN 2022-2023

Research Project Submitted to Faculty of Medicine,21 September UMAS in Partial Fulfillment of Requirements for MBBS.

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2023

ACKNOWLEDGMENT

First, our prayers are to Allah the most gracious, the most merciful for helping us in completing this humble work.

Second, many warm thanks covered with our love and gratitude for the full support, encouragement and inspiration of our families.

Third, special thanks dedicated to Dr. Faris AL-Hajami and Dr. Ahmed AL-Shahethi for their professional notes, comments and for accepting to be the supervisor of this study. We can't forget their roles in encouraging us to finish this study and for their efforts at every step of this monumental work.

Finally, we would like to thank all those who contributed directly and indirectly to the success of this humble effort, to the people who contributed in finishing this study and getting it in its final version.

DEDICATION

This research paper is dedicated to the parents of researchers who gave their outmost support, and never-end inspiration throughout the study. They are the one who provide the resources that needed in making this study.

It also dedicated the teachers who are behind in making this research possible through guiding the researchers to complete this study.

Also this study is dedicated to the school who gave opportunity the researchers to nurtures, test their skills, and cooperation to build this study.

We look up and dedicated this whole study to our almighty Allah who gave the strength, knowledge, wisdom, protection, and will to continue and keep positive to finish this research.

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LIST OF ABBREVATIONS

ALT	Alanine Transaminase
ALP	Alkaline Phosphatase
AST	Aspartate AminoTransferase
ASA	American Society of Anesthesiologist score.
AUROC	Area Under Receiver Operating Characteristic.
CBD	Common Bile Duct.
CHD	Common Hepatic Duct.
CLOC	Conversion from Laparoscopic to Open Cholecystectomy.
CR	Conversion Rate.
ERCP	Endoscopic Retrograde cholangiopancreatography.
GB	Gallbladder.
GSS	German Surgical Society Congress.
LC	Laparoscopic Cholecystectomy.
MIS	minimally invasive surgery
OC	Open Cholecystectomy.
ROC	Receiver Operating Characteristic.
SAGES	Society of American Gastrointestinal Endoscopic Surgeons.
SD	Standard Deviation.
SPSS	Statistical Package for Social Sciences.
US	UltraSound.
WBC	White Blood Cells.

Abstract

Background: LC is the gold standard approach for treatment of symptomatic cholelithiasis. Sometimes, the need for the laparoscopic conversion to OC is not a failure of surgery, but it is mandatory to avoid complications.

Objective: LC has become the gold standard for the surgical treatment of GB disease, but conversion to OC is still inevitable in certain cases. We decided to review the incidences and causes of conversion from laparoscopic to OC in AL-Thawra Modern General Hospital, Sana'a, Yemen.

Methods: This study is a retrospectively analyzed hospital - based medical records of patients who are diagnosed with cholelithiasis and had LC in the department of General Surgery in AL-Thawra Modern General Hospital, Sana'a, Yemen, to determine factors influencing the conversion of laparoscopic to OC. The study period is from 1st March,2022 to the 1st February 2023. The patients of all the surgical unit of the hospital included in the study. The group consist 110 patients with 101 females in rate of 91.8% and 9 males in rate of 8.2% from age of 19 to 62 years old. The patients were qualified for the operation both in the scheduled and emergency mode. The conversion was needed in 4 patients.

Results: Adhesion is the commonest cause of conversion as it seen in 50% of cases followed by large stone difficult to extract by laparoscopic hydrops GB in 25% and distortion anatomy of G.B and injury for CBD.

Conclusion: These risk factors will predict the difficulties of the procedure and this will permit the surgeons to inform better the patients about the risk of conversion from LC.

Keyword: Laparoscopic cholecystectomy, Open cholecystectomy, Conversions, AL-Thawra Modern General Hospital, Causes.

الملخص

الخلفية: استئصال المرارة بالمنظار هو المنهج المعياري الذهبي لعلاج التهاب المرارة. في بعض الأحيان، تحويل عملية النظار إلى عملية استئصال المرارة المفتوحة لا يعني فشل الجراحة ولكن لتجنب المضاعفات.

الهدف: أصبح استئصال المرارة بالمنظار المعيار الذهبي للعلاج الجراحي لحصوات المرارة، ولكن التحول إلى عملية استئصال المرارة المفتوحة لا يزال حتميا في بعض الحالات. وبحثنا يهدف إلى حصر حالات وأسباب التحويل من المنظار إلى عملية استئصال المرارة المفتوحة في مستشفى الثورة العام بصنعاء، اليمن.

الطرق: تم جمع البيانات الهامة لهذه الدراسة من سجلات طبية مستندة إلى المستشفى تم ترحيلها بأثر رجعي لملفات المرضى الذين تم تشخص إصابتهم بحصوات المرارة وسيتم استئصال المرارة لهم في مستشفى الثورة العام الحديث، صنعاء اليمن، لتحديد العوامل المؤثرة في تحويل المنظار إلى عملية استئصال المرارة المفتوحة.

فترة الدراسة من ١مارس ٢٠٢٢ إلى ١ فبراير ٢٠٢٣.

جميع مرضى الوحدة الجراحية في المستشفى المدرجة في الدراسة.

تتكون الدارسة من ١١٠ مريض، منهم ١٠١ إناث بمعدل ٩١,٨٪, و٩ ذكور بنسبة ٨,٢٪ من سن ١٩ إلى ٦٢ سنة.

تم تاهيل المرضى للعملية سواء في الموعد المحدد او في حالات الطوارئ، وكان التحويل في ٤مرضى

النتائج: الالتصاق هو السبب الأكثر شيوعا للتحويل كما يظهر في ٥٠٪ من الحالات تليها الحصوات الكبيرة والتي يصعب تحليلها عن طريق الحقن المائي بالمنظار بنسبة ٢٥٪, تشوه تشريحي للمرارة،وإصابة القناة الصفراوية المشتركة من أسباب التحويل.

الخلاصة: عوامل الخطر هذه ستتنباء بصعوبات الإجراء وهذا سيسمح للجراحين بإبلاغ المرضى بشكل أفضل بمخاطرة التحويل من استئصال المرارة بالمنظار إلى استئصال المرارة بعملية بطن مفتوح.

CHAPTER 1:

INTRODUCTION

1.1 Background

Gallstones are common particularly in Western populations. In the United States approximately six percent of men and nine percent of women have gallstones. Patients with gallstone disease may be asymptomatic or may present with biliary colic or complications of gallstone disease (Salam F Zakko, et al, 2022).

Gallstones are composed of a mixture of cholesterol, calcium salts of bilirubinate or palmitate, proteins, and mucin. Based upon the predominant constituents, gallstones are broadly classified into the following (Nezam H Afdhal,et al, 2022):

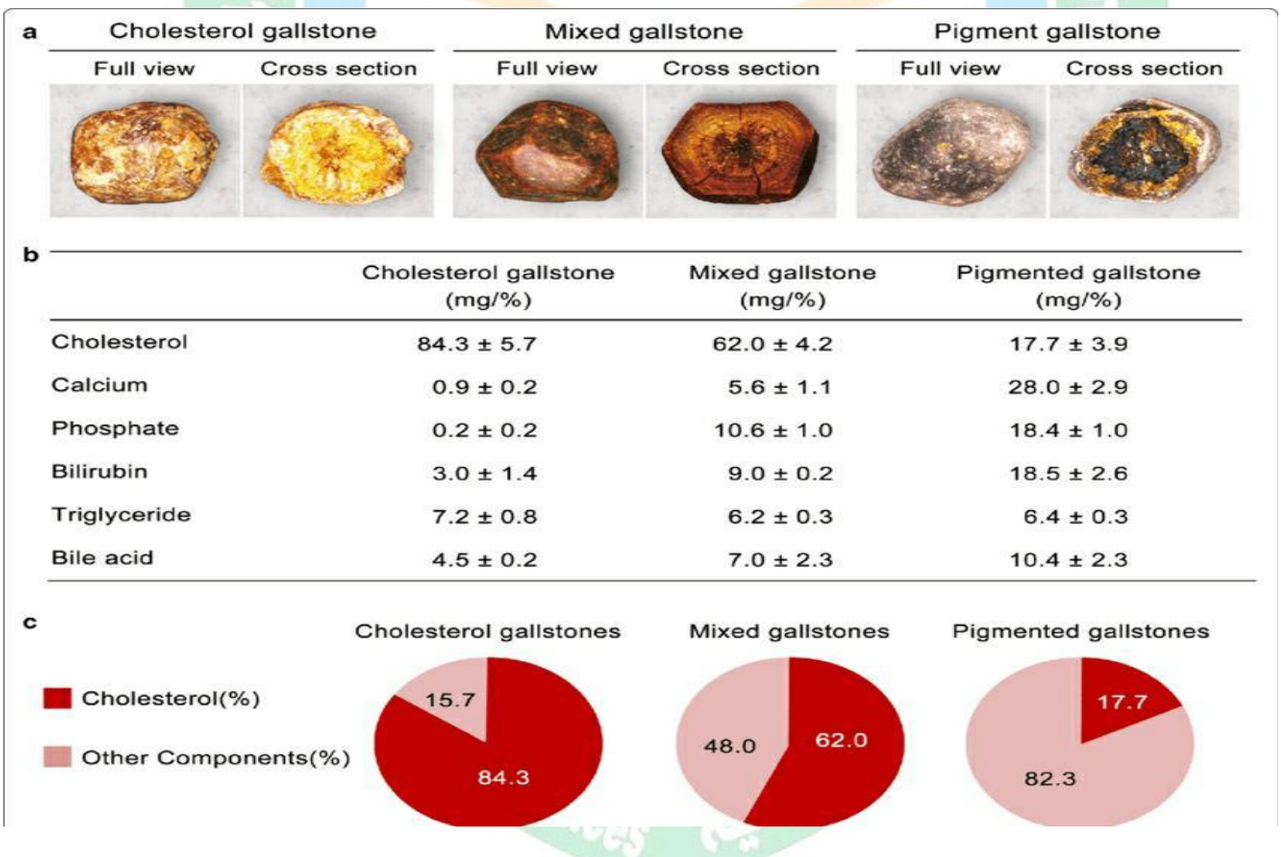

Figure 1 : Compostion of Gallbladder Stone

Overall prevalence of gallstones is exceedingly rare in children except in the presence of hemolytic states. Prevalence of gallstone disease increased with age in both gender, reaching a plateau after 50 and 60 years of age in females and males respectively (Salam F Zakko, et al, 2022).

Gallstone disease is a global health problem. Most patients are asymptomatic and gallstones which are generally detected with US during the evaluation of unrelated medical conditions (Nezam H Afdhal, et al, 2022).

Over the past two decades LC has become the gold standard for the surgical treatment of GB disease. A shorter hospital stays and thus a more rapid return to normal activity and work, decreased morbidity, less postoperative pain, a faster recovery, better cosmetic and good cost containment are some of the advantages of LC over open surgery. However, laparoscopic surgeons are faced with some limitations and intra-operative difficulties, such as hemorrhage and bile duct injury in case of intra-abdominal adhesions, which require more technical experience. LC has now replaced OC as the first choice of treatment of gallstones and inflammation of GB unless there are contraindications to the laparoscopic approach. This is because open surgery leaves patient more prone to infection. Sometimes, a LC will be converted to OC for technical reasons or safety (Volkan Genc, et al, 2011).

LC to replace classic OC as the gold standard for the treatment of cholelithiasis. Once introduced, the evolution to LC took place so suddenly and on such a large scale worldwide that, in the history of surgery, the last decade of the 20th century will certainly be remembered as that of the laparoscopic revolution. Few procedures have transformed so quickly and so dramatically the daily practice of every surgeon, and laparoscopic surgery has been firmly integrated into the curriculum of general surgery residency programs (Perissat J, 1999).

The first OC was performed on July 15, 1882, by the German surgeon Carl Johann August Langenbuch (1846 –1901) at the Lazarus Krankenhaus, Berlin, on a 43-year-old man (Morgenstern L, 1992). Earlier John StoughBobbs performed the first cholecystotomy on July 15, 1867, in Indianapolis, Indiana on a 30-year-old woman with an ovarian cyst and a 4-year history of biliary colic (Bobbs JS, 1868) (Traverso LW, 1976)

In 1630 Zambecarri and in 1667 Teckoff showed in animal experiments that the GB was not essential to life (Traverso LW, et al, 1976).

The history of laparoscopy began in 1901, when Russian gynecologist Dimitri Ott examined the peritoneal cavity of a pregnant woman by using a head mirror and a speculum introduced into a culdoscopic opening (Ott DO, 1901) (Himal HS, 2002). In the same year, German surgeon George Kelling visualized the peritoneal cavity of a dog by using a Notzecystoscope through the abdominal wall after filtered air had been inserted using a Fiedler puncture needle (called "koelioskopie") (Vecchio R, et al,2000). In 1911, a Swedish surgeon, Hans Christian Jacobaeus, reported his 10-year experience of 115 examinations in 72 patients. He was able to inspect both abdominal and chest cavity, without pneumoperitoneum, and he called the technique "laparothorakoskopie" from the Greek words "lapara" (meaning the part of the body corresponding to the abdomen), "thoraco" (chest) and "skopein" (meaning to look at) (Jacobaeus HC, 1911). During the same year, Bern Keim performed the first laparoscopy in the United States of America. He reported his experience using an electric headlight and a proctoscope (called organoscopy) in a patient with pancreatic cancer and in a patient with chronic appendicitis (Bernkeim BM, 1911).

In 1924, Zollikofer used carbon dioxide to produce pneumoperitoneum (Zollikofer R, 1924), and in 1929, the German Kalk designed a lens system with a 45-degree scope to permit better inspection of the abdominal viscera (Kalk H, 1929).

The first operative laparoscopy was reported in 1933 by the German Fervers who performed abdominal adhesiolysis under visualization (Vecchio R, 2000). In 1937, the Hungarian Veress first described the use of a Veress needle for the creation of pneumoperitoneum (Veress J, 1938).

Laparoscopy became a vital part of gynecologic practice throughout the 1960s and 1970s. On September 12, 1980, gynecologist Kurt Semm, one of the pioneers of laparoscopic surgery, performed the first laparoscopic appendectomy using a suture technique (Semm K, 1938).

During this period, gynecologists described several therapeutic laparoscopic procedures, including tubal ligation, ovarian cystectomy, incision and drainage of tubo-ovarian abscesses, and lysis of pelvic adhesions for chronic pelvic pain (Himal HS, 2002).

Paradoxically, laparoscopy did not gain acceptance in the field of general surgery. The prevailing surgical dogma of the time was “the larger the cut, the better the surgeon” (Spaner SJ, 1997).

15 On March 17, 1987, Philippe Mouret performed the first LC, in Lyon, France. This date represents a profound epistemological leap: “before that, there was nothing, after that there was laparoscopic surgery (Mouret P, 1996).

Patients have deserted the waiting rooms of conventional surgeons and crowd into those of the laparoscopic surgeons. Moreover, laparoscopic surgery now forms a fundamental part of all standard surgeons’ training courses (Perissat J, 1999).

According to Philippe Mouret, the first cholecystectomy was performed quite naturally without premeditation. The patient was a woman of about 50 years, suffering from painful pelvic adhesions, who had been referred to him for laparoscopic adhesiolysis. The patient also suffered from symptomatic GBlithiasis, and had asked him if he would perform both operations at the same time. The operation schedule mentioned: laparoscopy, gynecological adhesiolysis, and cholecystectomy (Mouret P, 1996).

He performed a systematic primary exploration of the GB, which was the second procedure on the schedule. The exploration was easy due to the leanness of the patient. Quite naturally and without even thinking that he would be able to complete the procedure, he started making preparations that seemed possible for the later cholecystectomy. He had considerable experience in laparoscopic surgery. He had performed 8000 previous laparoscopies and more than 100 appendectomies. This experience allowed him to perform the LC in reasonable safety. On the following first postoperative day, he found the patient fully dressed and with every intention of leaving the hospital. She reproached him coldly for not having also operated on her GB , as he had promised (Mouret P, 1996).

Mouret repeated the procedure approximately 15 times during 1987. However, things started off in 1988 when Francois Dubois, who had been informed by a nurse, met Mouret and started experimenting on animals, and achieved extraordinary success after only a few months. Mouret then met Jacques Perissat, who improved the technique and his support instantly made the procedure appear respectable to the University, which had been resistant to change (Mouret P, 1996).

The use of LC also began in the United States around the same time. J. Barry McKernan and William B. Saye performed the first LC on June 22, 1988 in Marietta, Georgia (Litynski GS, et al, 1996) followed by Eddie J. Reddick and Douglas O. Olsen of Nashville, Tennessee (Reddick EJ, et al, 1991).

Previously, in 1983, the Russian Lukichev performed the first LC but its publication was limited to the Russian literature, and it remained unknown (Lukichev OD, et al 1983).

However, the first actual LC was performed by Prof Dr Erich Muhe in Boblingen, Germany, on September 12, 1985. He performed 94 such procedures before Mouret had performed his first LC in 1987 (Litynski GS, et al, 1996) (Muhe E, 1986).

However, this innovative technique was not widely accepted. Muhe was largely ignored and faced severe criticism from the German medical establishment. Instead, it was Mouret who was responsible for laparoscopic surgery achieving medical respectability by performing the first LC (Meyer G,et al, 2001).

In 1986, Muhe presented his findings on LC before the GSS, when his lecture had not been included in the proceedings and next presented the lecture on cholecystectomy without laparotomy to the Lower Rhine-Westphalian Society in October 1986 in Cologne. The audience was skeptical of his claims, and the response was disappointing. In 1990, his article about the first LCs submitted to the American Journal of Surgery was rejected because of his difficulties with the English language. Finally, at the 109th GSS on April 21, 1992, his pioneering work in endoscopic surgery was recognized as one of the greatest original achievements of German medicine in recent history, and Muhe received the GSS Anniversary Award (Reynolds W Er , 2001).

In April 1989, Professor Jacques Perissat, whose presentation had not been accepted in the main program at the meeting of the SAGES in Louisville, Kentucky displayed a videotape on LC and described his technique in a remote booth of the exhibition area. This videotape quickly attracted a larger audience than did the lecturers in the main auditorium (Dent TL, 1997), and marked the beginning of the worldwide revolution in laparoscopic surgery for general surgeons (Himal HS, 2002).

LC was completely incorporated into general surgery in an astonishing 2 years to 3 years, and reports of the successful use of laparoscopy in larger clinical studies led to the rapid development of MIS. Although the first published reports were greeted more with criticisms than with compliments, LC being typically characterized as “a futureless technique,” “circus surgery,” and “a media show of a tightrope dancer who is totally careless of the risks for the patients,” the subsequent rapid acceptance of the technique of laparoscopic surgery by the general population is unparalleled in surgical history. The rapid development of MIS was partially attributable to the interests of the industries involved in these new techniques and the associated devices, but most of all it was a natural evolution driven by the increasing number of patients who requested MIS (Meyer G, et al, 2001).

LC has spread rapidly worldwide mainly because postoperative pain is less, recovery is more rapid, cosmetic results are better, hospital stays are shorter, and the return to work is quicker than with the open procedure. Moreover, the traditional absolute contraindications for LC in certain specialized situations have largely been resolved and rendered relative, including the presence of acute cholecystitis, a history of previous abdominal surgery, morbid obesity, pregnancy, cirrhosis and even situs inversustotalis. Most cases of OC now only occur as conversions from a laparoscopic approach. Therefore, inclusion of the term “laparoscopic” is essentially a pleonasm, and perhaps simply “cholecystectomy” should be used when referring to the LC procedure, with the full term “OC” used for classic OC. It appears that surgical techniques evolve faster than the corresponding terminology (Slim K, 2004).

A natural consequence was the development of new laparoscopic techniques for many other organs including the abdominal wall for repair of hernia, the colon, the stomach, the esophagus, the kidney, the spleen, the bladder, the adrenal gland, the pancreas, the liver, the CBD, the aorta, and other intrathoracic structures. In addition, the first transnational telesurgery was performed in 2001 on a patient in France while the operating surgeon was 6.500 km away in New York (Marescaux J, et al, 2001).

The introduction of LC represents a historical turning point that is just as momentous as the discovery of anesthesia, asepsis, antibiotics, extracorporeal circulation, and the use of operating microscopes. It is consistent with the general trend of introducing more efficacy and fewer constraints in all modern therapeutics, but where it will lead remains difficult to predict (Perissat J, 1999).

It is now crucial for all general surgeons to keep up with this trend toward laparoscopic procedures and thereby become an integral part of the revolution in medicine created by the advent of MIS (Himal HS, 2002).

LC has supplanted OC for most GB pathology. Experience has allowed the development of now well-established technical nuances, and training has raised the level of performance so that safe LC is possible. If safe cholecystectomy cannot be performed because of acute inflammation, LC tube placement should occur. A systematic approach in every case to open a window beyond the triangle of Calot, well up onto the liver bed, is essential for the safe completion of the operation (Demetrius E.M, et al, 2008).

Indications

The indications for LC have remained relatively constant and include symptomatic gallstones manifesting as biliary colic, acute cholecystitis , chronic cholecystitis, gallstone pancreatitis, and biliary dyskinesia, and the complications of acute and chronic GB disease (Demetrius E.M, et al, 2008).

Contraindication

Patients who cannot tolerate general anesthesia or major surgery should not undergo LC. Other options, including Percutaneous Cholecystectomy , should be considered in these patients. Conditions such as pregnancy, cirrhosis, and coagulopathy are no longer contraindications to the laparoscopic approach but require special care and preparation of the patient by the surgeon and a careful evaluation of risk versus benefit (Demetrius E.M, et al, 2008)

In the early years of LC the incidence of CBD injury was increased in LC when compared with open surgery. Although the CBD had always been at risk during GB surgery, referral centers began to see large numbers of complicated CBD injuries that coincided with the advent of LC. The reasons for the increased injuries were multifactorial but learning curve phenomena and relative inexperience with laparoscopic techniques no doubt played an important role. Today surgeons who are trained in (Demetrius E.M, et al, 2008).

The conversion to open procedure is defined as the surgeon's decision to resort a laparotomy (because of obscure anatomy or lack of progress of the laparoscopic procedure) before being forced to do so as a result of a major intra-operative complication or as enforced when an intra-operative emergency such as uncontrollable bleeding or bile duct injury occurs. The most recognizable causes for conversion are obscure biliary anatomy, presence of dense peri-cholecystic adhesions, intra-operative bleeding, failure of the progression and suspicion of choledocholithiasis. Worldly we observe OC is important as the last resort for the save surgical practice in complicated cases (John Griniatsos Ann, 2018).

1.2 Statement of Problem

LC is the gold standard treatment for symptomatic cholelithiasis due to its effectiveness and safety. Moreover, the benefits of are less post-operative pain, faster recovery, earlier return of bowel function, and shorter hospital stay when compared to conventional cholecystectomy. Although, the LC is the most common operation performed these days, some of the intended LC require conversion due to several factors. Many a time it demands conversion to OC due to intra-operative complications for the safe ending of the procedure and takes more than anticipated time. Most of the time, the levels of difficulties are hard to assume. Nevertheless, it is a necessary to predict so that the patient can be informed regarding the possibility of conversion. Likewise, the surgeon can get mentally prepared to be ready for having a good surgical team, intra-operative cholangiogram, the timing of the procedure and have overall preparedness to defy the difficult cholecystectomy for better postoperative outcomes. It is always better to know the predictors to complete such challenging surgeries. Based upon the risk factors like patient demographics such as age, gender, body weight, co-morbidity, and (ASA score), along with clinical findings (acute versus chronic cholecystitis), and the surgeon's experience; the chance of possible complications, and conversion into open surgery can be estimated. Therefore, the knowledge about consistent predictors for difficult cholecystectomy would be particularly beneficial to only to set appropriate management plan, but also to assemble available resources to defy difficult LC.

This study aimed to determine the causes and incidences of laparoscopic conversion of cholecystectomy in AL-Thawra Modern General Hospital, Sana'a, Yemen.

1.3 Rational of Study

There is no doubt that LC replaced OC as standard procedure for the treatment of symptomatic cholelithiasis due to its effectiveness and safety. LC is getting popularity in developing countries, but conversion of laparoscopic to OC is still required in many circumstances, and there are a few studies that determine the causes of conversion to LC in Yemen, so this study will be conducted to identify the causes and incidences of laparoscopic conversion to OC and to establish the efficacy and safety of the procedure in AL-Thawra Modern General Hospital, Sana'a, Yemen.

CHAPTER 2:

LITERATURE REVIEW

2.1 Previous Study

The prevalence of cholelithiasis varies widely by geographic region and appears to be higher in White and Native American populations as compared with Eastern, European, African, American, and Japanese populations. The variation in the prevalence of gallstones may be attributable to both genetic and dietary factors. In North America, Native Americans appear to have high prevalence of cholelithiasis and GB disease. As an example, in one study that includes 596 Pima Indians, 290 (49 percent) had gallstone disease. Gallstone disease was more prevalent in females as compared with males with a peak prevalence of 73 percent in females between the ages of 25 and 34 years. Similar high rates have been found in multiple other Native American populations (Everhart, et al, 2002).

USA Study showed that over the 52-month study period, 2284 patients underwent cholecystectomy. Among patients undergoing cholecystectomy, LC was attempted in 2205 (96.5%) patients, and primary OC was performed in 79 (3.5%) patients. Of the 2205 attempted LCs, 2096 (95.1%) were completed successfully, and 109 (4.9%) were converted to the open procedure. An average of 441 LCs was attempted annually with the greatest number (N=515) performed in 2006. The annual rate of attempted LCs ranged from 94.8% (457 of 482 total cholecystectomies in 2005) to 97.4% (446 of 458 total cholecystectomies in 2007) (P0.06). The annual CR ranged from 3.7% (19 of 515 attempted LCs in 2006) to 7.2% (33 of 457 attempted LCs in 2005) (P0.02). Depicts the various reasons for laparoscopic conversion in all 109 patients. Presence of adhesions defined as scar tissue in response to prior surgery, trauma, or inflammation was the most common reason for conversion (44 of 109 patients, 40.4%). Among the 109 patients who underwent laparoscopic conversion to open, 54.1% (N=59) had no prior history of abdominal surgery. However, among the conversions due to adhesions, 54.5% (N=24) had a history of abdominal surgery, while 45.5% (N=20) had no history of abdominal surgery. The second most common reason for conversion was technical difficulty (25 of 109 patients, 22.9%), and of these cases 22 surgeons cited inadequate visualization in the absence of hepatomegaly, 2 cited inadequate visualization in the presence of hepatomegaly, and one cited inadequate pneumoperitoneum(Sujit Vijay Sakpal, et al, 2010).

Additional reasons for conversion included (in order of most common to least common): iatrogenic injury (N=12), severe acute inflammatory process (N=12), hemorrhage (N=7), anomalous biliary anatomy (N=3), bile leak/bile peritonitis (N=3), CBD stone (N=2), and choledochoduodenal fistula (N=1). Among patients with iatrogenic injury who underwent laparoscopic conversion, 7 patients incurred GB perforation, 2 incurred CBD injury, 1 incurred right posterior sectoral duct injury, and 1 incurred an enterotomy. CBD injury at our institution occurred in 0.1% (2 of 2205) of all attempted LCs and accounted for 1.8% (2 of 109) of converted LCs. Of those patients with bile leak/bile peritonitis, one had perforated (noniatrogenic) cholecystitis, another had sustained erosion of the T-tube into the CBD, and the third leaked bile through a remnant GB infundibulum(Sujit Vijay Sakpal, et al, 2010).

Patient-Specific Characteristics: In patients in whom LC was attempted, 74.7% (1647/2205) were females, and 25.3% (558/2205) were males. The mean age of patients in whom LC was attempted was 50.5 years old. The mean age of patients undergoing successful LC was 49.6 years old and 66.1 years old among those converted to OC (P0.0001). Twenty pediatric (age18) patients 0.9% (20/2205) underwent LC, and there were no conversions to OC. Cholecystectomy was performed slightly more often in patients 50 years of age versus those 50 years of age (50.2% (N=1146) versus 49.8% (N=1138); P0.06). LC was attempted in a larger proportion of patients 50 years of age versus those 50 years of age [98.7% (N=1123) versus 94.4% (N=1082); P0.0001, respectively), and a larger proportion of patients 50 years of age versus those 50 years of age underwent conversion to OC (8.8% (N=92) versus 1.5% (N=17); P0.0001).A larger percentage of females versus males underwent cholecystectomies (73.8% (N=1686) versus 26.2% (N=602), P0.0001), and LCs were attempted in a larger percentage of females versus males (97.7% (N=1647) versus 92.7% (N=558); P0.0001). On the contrary, a larger proportion of males versus females underwent conversion to OC (9.1% (N=51) versus 3.5% (N=58), P0.0001) (Sujit Vijay Sakpal, et al, 2010).

Surgeon-Specific Characteristics: The overall CR of LCs performed by high-volume surgeons was significantly lower in comparison with that of low-volume surgeons (4.5% (N=77) versus 8.3% (N=23); P0.01). The CRs ranged from 1% (1/113) to 6.5% (10/155) in the high-volume group and 0% (0/40) to 15.3% (11/72) in the low-volume group. The average number of cases collectively performed over a year by the high-volume group was 216 (range, 113 to 616), and the number of cases performed by the low-volume group was 69 (range, 41 to 99) (Sujit Vijay Sakpal, et al, 2010).

The annual CRs among surgeons who performed 20 cases/year and those who performed 8 to 20 cases/year did not differ significantly (P0.07 to 0.7). CRs among surgeons who performed 20 cases/year reached their nadir in 2006 at 3.7% (N=515) and peaked in 2005 at 7.2% (N=457). CRs among surgeons who performed 8 to 20 cases/year reached their nadir in 2007 at 0% (N=32) and peaked in 2005 at 13% (N=77). CRs were lower among surgeons who completed residency training after 1990 versus those who completed training before 1990 (4.2% (N = 44) versus 5.8% (N=56); P0.1). In addition, surgeons with fellowship training had lower CRs than those without additional training (4% (N=17) versus 5.3% (N=83); P0.3). Moreover, the percentage of conversions due to technical difficulty intraoperative complications were lower among surgeons with fellowship training (29.4% (N=5) versus 38.6% (N=32); P0.3) but was higher among those who had completed training after 1990 (45.5% (N=20) versus surgeons trained prior to 1990: 30.4% (N+17); P0.2) (Sujit Vijay Sakpal, et al, 2010).

British study showed that overall, 297 out of 8820 (3.4%) LC were converted to open. Mean patient age was 51 ± 17 years and 73.9% were female. Procedural difficulty was graded3–4 in 94% of converted procedures compared to only 27% of laparoscopic procedures ($p < 0.001$; Fisher's exact test). Compared to laparoscopic procedures, converted procedures took significantly longer, and were associated with longer hospital stay, as well as increased morbidity and mortality.Although the specific indications for conversion were not collected prospectively in the CholeS study protocol, bile duct injury (N = 7), bowel injury (N = 12) and bleeding (N = 64) were observed in 83 out of 297 (28%) converted patients. Of the remainder, operative difficulty was graded 3 or 4 in 170 (57%), and 35 patients (12%) underwent bile duct exploration. The reason for conversion was unclear in 9 patients (3%). Of 8523 patients who successfully underwent LC without conversion, the operating time was longer than 2 h in 544 patients (6.4%). However, a prolonged laparoscopic procedure (>2 h) was associated with increased overall complications (17.5% vs. 9.3%; $p < 0.001$), bile leak (3.7% vs. 0.8%; $p < 0.001$), bile duct injury (1.8% vs. 0.13%; $p < 0.001$) and longer median hospital stay (2 vs. 1 days; $p < 0.001$) compared to shorter laparoscopic procedures (less than 2 h) (Robert P Suticlifffe, et al, 2016).

Thirty-three percentage of patients who underwent a prolonged LC had a postoperative length of stay 5 days. The morbidity (18% vs. 33%; $p < 0.001$) and median length of hospital stay (2 vs. 6 days; $p < 0.001$) after a prolonged LC were significantly less than after converted cholecystectomy. The data were then divided into two random groups, a main set (N = 6615; 3.3% converted to open), which could be used to produce a risk score, and a validation set (N = 2205; 3.4% converted to open) to validate the resulting score. Within the main set, the association between preoperative variables and conversion was evaluated by univariable analysis of a range of patient and surgical factors. Several patient-related (age, gender, ASA) and disease-related factors (GB wall thickness, bile duct diameter, indication for surgery, previous ERCP) were found to be significantly associated with conversion to open surgery. Body mass index was not found to be a risk factor for conversion in this analysis. On multivariable analysis, six factors (age, gender, ASA, indication, GB wall thickness and bile duct diameter) were identified as significant independent predictors of conversion, whilst type of admission ($p = 0.225$) and previous ERCP ($p = 0.141$) were no longer significant. The model's accuracy was tested using ROC analysis, and returned an area under the curve (AUROC) of 0.811 (SE = 0.013; $p < 0.001$). The model was then transformed into a Conversion from Laparoscopic to OC risk score (CLOC score), by rounding the coefficients to the nearest integer, after multiplying by two to minimize the effect of rounding errors. In order to generate a CLOC score for a patient, the number of points for each of the factors, and added together, giving a score in the range of 0–14. The simplification of the logistic regression model into the CLOC score had minimal impact on its accuracy (AUROC 0.802; SE = 0.013; $p < 0.001$). The score was then applied to the validation set of patients, resulting in an AUROC of 0.766 (SE = 0.027; $p < 0.001$). The performance of the risk score for both sets of data is shown graphically in Fig. 1. The ROC curve from the validation set was then used to identify the best cut off from the risk score. Based on the Youden's J statistic, the optimal grouping was to classify patients with scores >6 as high risk, which yielded a sensitivity of 77.1% and a specificity of 65.4%. In the validation set, the risk of conversion to open for low (CLOC 6) and high risk (CLOC > 6) patients was 1.2% and 7.1%, respectively. Hence, patients identified as high risk have a near six-fold higher rate of conversion than low risk patients. The CLOC score was found to be significantly associated with the intraoperative assessment of operative difficulty (Spearman's rho = 0.386; $p < 0.001$), and also correlated with bile duct injury, whether diagnosed intra- ($p = 0.032$) or postoperatively ($p = 0.035$)" (Robert P Suticlifffe, et al, 2016).

"Indian study showed that Out of the 100 patients that underwent LC, 7 required conversion to OC. It was seen that 88 patients were female while only 12 were male but the rate of conversion was higher in males2 out of 12 (16.67%) while it was only 5.68% (5 out of 88) in females. The maximum number of patients were in the age range of 41-50 years i.e 26 cases and minimum of 4 cases in ≤20 years. The mean age was 41.29 years. Maximum rate of conversion was seen in patients in range 61-70 years i.e. 20% (2 out of 10 cases). It was seen that the chances of conversion increased with the increase in age but the change in rate of conversion with respect to age was not found to be significant($p=0.246$). Out of 100, 25 patients had history of multiple attacks of biliary colic and 4 out of those needed conversion i.e. 16%. 75 patients on the other hand had experienced single episode of biliary pain and 3 out of those i.e. 4% needed conversion. Thus, history of multiple attacks of cholecystitis led to a higher chance of conversion probably because of the fibrosis and adhesions caused by the same. 32 out of 100 cases had tenderness in the right hypochondrium at the time of presentation out of which 5 (15.63%) needed conversion to OC mainly due to intra-operative adhesions. 68 patients did not have tenderness at the time of admission and only 2 out of those (2.94%) needed conversion. Multiple intra-operative findings were analyzed and it was seen that certain cases had a higher rate of conversion- contracted GB, thickened GB walls, multiple calculi and size of calculi >1 cm were some factors that had higher incidence of conversion but the results were not significant. Identification and appearance of the CBD had a significant relation to rate of conversion ($p=0.0001$). Out of 100 cases, CBD was normal in 93 out of which 3 needed conversion i.e. 3.26%. In 5 cases, CBD was dilated with 1 having stones in it. 2 out these 5 cases required conversion to OC i.e. 40%. The patient with choledocholithiasis underwent CBD exploration with T-tube insertion. In 2 cases, the CBD could not be identified laparoscopically and both underwent conversion to confirm the same i.e. 100%. Also, achievement of critical view of safety was significantly related to rate of conversion ($p=0.001$). Critical view of safety was achieved in 78 out of 100 cases out of which only 1 (1.28%) needed conversion. Critical view of safety could not be achieved in 22 out of 100 cases out of which 6 (27.27%) needed to be converted into OC. The intra-operative factors responsible for conversion in all the cases were evaluated. Adhesions were seen in 33 out of 100 cases but were dense enough to lead to conversion to OC in 5 of those (15.15%). Anatomy at Calot's triangle was obscured in 6 out of 100 cases and 50% of those needed conversion to an OC. Bleeding severe enough to obscure vision and that could not be laparoscopically controlled was seen in only 1 case in the series and it needed to be converted for completion of the procedure(Anam Saeed, et al, 2020).

An aberrant branch of right hepatic artery was the source of the bleeding. intra-operatively, CBD stones were found in 1 case which were not detected in the pre-operative abdominal US. The preoperative liver function tests of the patient were also within normal limits. Laparoscopic procedure was abandoned and OC with CBD exploration was performed and a T-tube inserted into the CBD after retrieval of CBD stones. No cases of visceral or biliary injury were seen in present study neither was there any instrument failure. Operative time for all the cases was recorded. It ranged from a minimum of 55 to a maximum of 132 minutes. The mean operative time for cases completed laparoscopically was 76.47 minutes while for converted cases was 120.57 minutes. 75 out of 100 cases were completed in The mean post-operative stay for cases completed laparoscopically was 2.29 days while for those converted to OC was 5.57 days. Out of the 93 cases that were completed laparoscopically, 71 (76.34%) were discharged on post-operative day 2, 17 (18.28%) on post-operative day 3 and 5 (6.38%) on day 4. Out of the 7 patients who underwent conversion to OC, 4 (57.14%) were discharged on postoperative day 4, 2 (28.57%) on post-operative day 5 and the 1 (14.29%) patient who underwent CBD exploration was discharged on post-operative day 13" (Anam Saeed, et al, 2020).

"Iraq study Showed that from 150 patients who underwent LC 25 patients were males (16.66%) and 125 patients were females (83.33%). Nine conversions were obtained (CR was 6%), 3 conversions were males and 6 patients were females so the percentage for conversion in males from the total conversions is 33.33% and for females is 66.66% and the CR for male patients from the total male cases was 12% and for female patients from the total female cases was 4.8%.the average age for conversions was 50 years. The causes of conversions were obtained depending on the decision of the surgeon according to the difficulty faced during surgery or technical faults and other associated causes. The causes of conversions were as follow: Three patients' conversion were due to dense adhesions and disturbed anatomy that could not guaranteed safe dissection and clipping (33.33%). In two patients the cause was empyema of the GB (22.2%), one patient due to severe obesity that it was very difficult to negotiate the dissection by the standard ports (11%), vascular injuries in 2 patients (22.22%), one patient due to anatomical malposition of the gall bladder (intrahepatic) (11%). The most common cause for conversion in the study was disturbed anatomy due to dense adhesions with the difficulty to carry out a clear and safe dissection. In order to give insight to readers, the CR from other studies was presented here. It is observable that the highest CR cited from Pakistan, followed that from Texas and the lowest from Georgia medical Centre" (RafeaJasim Hussein Al-Shammari, et al, 2018).

"Egypt study showed the reasons for conversion of 234 (5.3%) of the patients scheduled forLC in the study period, who then underwent conversion to OC. There were 115 (49.1%) males and 119 (50.5%) females with a mean age of 47.7 ± 10.8. The commonest cause of conversion was dense pericholecystic adhesions (54.7%), followed by inability to accurately define the biliary anatomy (21.4%). A friable or gangrenous GB difficult to grasp accounted for 4.3% of the converted cases. Conversion was required for hemodynamic instability in 3% and technical factors including instrument failure also accounted for 3%. Conversions in order to control bleeding occurred in 14 (6%) patients. These cases included 8 with bleeding from the cystic artery and 5 with bleeding from the GB bed in a cirrhotic liver. One case was converted in order to control bleeding from the right iliac artery because of injury during the initial port insertion. A vascular repair was performed and the patient recovered smoothly and was discharged and on anticoagulants for 6 months. Suspected CBD injury or bile in the operative field resulted in conversion in 5 (2.1%) patients. Intraoperative cholangiogram after conversion revealed an intact CBD in all cases. The CR decreased from 6.7 to 3.6%, when the first 5 years of the study period are compared to the last 5 years ($p < 0.001$). Risk Factors for Conversion Univariate analysis of risk factors for conversion, revealed the significant factors to be: male gender, increasing age, age >50 years, a history suggestive of acute cholecystitis or of previous upper abdominal surgery, a palpable GB, a raised white blood-cell (WBC) count, a WBC count >9, elevated AST, ALT or ALP, a thickened GB wall >4 mm on preoperative sonography and urgently indicated cholecystectomy. Independent risk factors that were significantly predictive for conversion were male gender, age >50 years, a history of previous upper abdominal operation, a WBC count >9 × 103 /μl, and urgently indicated cholecystectomy. Operation Time and Postoperative Course Operation time was longer with conversion (87 ± 29 min) when compared to LC (48 ± 16, $p < 0.001$), with a prolonged hospital stay of 3.7 ± 1.2 days compared to 2.1 ± 0.7 days ($p < 0.001$). Both groups had a similar postoperative complication rate of 2.1%. One case that was converted to OC because of empyema developed bile duct stricture 2 months postoperative that was repaired with Roux-en-Y hepaticojejunostomy. No cases in the LC group developed major biliary injury" (Ayman El Nakeeb, et al, 2013).

"Saudi Arabia Study showed 340 patients 314 (92.4%) were women with a mean (SD) age of 41.4 (12.5) years and 26 (7.6%) were men with a mean age of 48.2 (13.19) years. The female-to-male ratio was 12:1. Indications for surgery were chronic calcularcholecystitis in the 290 patients (85.0%) who presented on an elective basis; the remaining 50 patients (14.7%) were admitted for treatment of acute cholecystitis. US demonstrated cholelithiasis in all the cases. Conversion to laparotomy occurred in 17 patients (5%). Preoperative complications leading to immediate or delayed laparotomy included injury to the CBD (two patients) and bile leakage due to a loose clip on the cystic duct in one patient. The incidence of complications was 3.2%. The most common complication was postoperative transient pyrexia, which was seen in four patients (1.2%)" (JawidMalek, et al, 2010).

Previous Yemen study from January 2001 to December 2005 LC was attempted in 709 patients at Kuwait University hospital in Sana'a. There were 648 women and 61 men with mean age of 38 years (Range 14 to 86 years). Conversion from laparoscopic to open surgery was required in 59 patients (50 women and 9 men) with 8.3% of CR. A total of 554cases (78.1%) were performed by consultant surgeons, and 48 patients needed conversion (8.7%) while 155 cases (21.9%) were performed by juniors, 11 patients needed conversion (7%). The CRs remained relatively stable throughout the study period except slight decrease in the last year (2005). All converted cases (n=59 with 8.3% CR) were considered as difficult cases except five cases. Two of the five cases were converted because of stone spillage into abdominal cavity. One patient was converted due to fault in gas insufflator, which suddenly stopped working, and two were converted on the request of anesthetist because of hypertension in one patient while in the other one because of decreased O2 saturation. Dense and extensive adhesions prohibiting laparoscopic dissection in Calot's triangle were the most common reason for conversion (n= 20; 33.9% of converted cases). Intraoperative complications during LC have occurred in 67 patients (9.4%). Fifty-three of 67 patients had minor complications that did not need conversion. The conversion due to operative complications was only required in 9 patients with CR of 15.3 % of all converted cases. Complications in twelve patients were assigned as major complications (2 CBD and one CHD injury, one perforation of the duodenum and 8 bleeding, three of which were uncontrolled and required conversion) (Saeed Hadi Al-Bahlooli, et al, 2009).

Two bile ducts injuries have been identified during operation and were converted. The third case was diagnosed one week after operation and required laparotomy and T-tube for 3 months. Out of the 8 bleeding, 3 cases were uncontrolled and required conversion, while the other five cases have been laparoscopically dealt with. Two cases were converted due to stones spillage. Unfortunately, the perforation of the duodenum has been identified as late as one week after LC. It required reoperation, closure and drainage. Three of nine complications were caused by consultant surgeons (33.3%) while 6 cases were caused by juniors (66.7%) (Saeed Hadi Al-Bahlooli, et al, 2009).

Another Yemen study showed that enrolled 116 patients submitted to cholecystectomy. Of these, 50 formed the OC group and 60 were included in the LC group, while the remaining 6 were converted to OC.Females were 108(93. 1%).The overall age range was 29-75 years, with a mean of 45.6± 9.4. Although there was no statistically significant relationship between age group and the selected type of operation (P> 0.05), it was noticed that, a higher percentage of them (85.7%) were operated on by LC. A majority of those less than 80 years (85.7%) had LC done. Operation time for OC was 50-170 minutes with amean of 85±32 minutes, while LC time was 45-135 and a mean of 80±24. Operation time in the 6 patients who were converted to open surgery was longer, 100 -160 minutes and a mean of 110±24, they were not included in the comparison.CR of LC was 9.1%(6 of 66 patients). Sever adhesions were the most common (6.1%) 4 patients. Of these, 2 (50%) had acute cholecystitis. Instrument failure 1 patient (1.5%) and obesity one patient (1.5%). By studying the variables implicated for LC, it is found that only patient with a diagnosis of acute cholecystitis had statistical association for conversion to open surgery (P value = 0.03 by Fisher exact test) Studying the preoperative risk factors correlation to postoperative complications in each surgical method. It is found the age of ≥60 years and a diagnosis of acute cholecystitis were of statistical significance to postoperative complications in the LC group with a P value of 0.02 and 0.01 respectively, by Fisher exact test only obesity had a higher association to postoperative complication but with no statistically significance P value = 0.08 (Nasser A Harhra, et al, 2012).

2.2 Aim of the Study

The aim of this study is to assess the causes and incidences of converted LC in AL-Thawra Modern General Hospital, Sana‘a, Yemen.

Objective of the Study

1. evaluating the rate of incidence of conversion in relation to age, gender, abdominal injury and pathological condition of biliary tract.
2. assessing the difficulties facing our surgeons during the procedure and relationship between the rate of conversion and the surgeon‘s experience.
3. Determining the most common cause of laparoscopic conversion in AL-Thawra Modern General Hospital.

CHAPTER3:

RESEARCH METHODOLOGY

3.1 Study Design

This study was a retrospectively analyzed a hospital - based medical records of patients who are diagnosed with cholelithiasis and had LC in the Department of General Surgery in AL-Thawra Modern General Hospital, Sana'a, Yemen.

3.2 Study Area and Period of the Study

The study conducted in department of General Surgery in AL-Thawra Modern General Hospital, from 1st March 2022 to the 1st February 2023.

3.3 Study Population

All the patients who diagnose cholecystectomy that referred to the general surgical department in AL-Thawra Modern General Hospital, Sana'a, Yemen.

3.4 Sample Size of the Study

The sample of the study was 110 patients collected from 1st March 2022 to the 1st February 2023.

3.5 Inclusion Criteria

- All patients with symptomatic cholelithiasis, including acute cholecystitis, and ultrasound abdomen (US) demonstrating cholelithiasis and normal CBD.
- Laparoscopic (LC) admitted in patients with GB malignancy, and any other anaesthetic risk. In patients with choledocholithiasis and acute pancreatitis,
- LC did after clearance of CBD by (ERCP).

3.6 Exclusion Criteria

Cases with incomplete laboratory or histopathology data and patients who were lost to follow-up are excluded.

3.7 Data Collection Technique

Evaluated the medical files of patients with gallstone disease who underwent LC in the Surgery Department of in AL-Thawra Modern General Hospital, Sana'a, Yemen from 1st March 2022 to the 1st February 2023, data collected by using Questionnaire.

Preoperative data, including patient demographics, mode of admission (elective or emergency), indications for cholecystectomy, concomitant disease (diabetes mellitus, obesity, hematological disorder, cardiovascular disease, or respiratory disease), and the existence of previous upper abdominal incisions, were collected. The CR to OC, the underlying reasons, and postoperative complications were recorded.

3.8 Data Analysis

Data were analysis by SPSS version 25 software. The study patient characteristics summarized using means with SDs for the continuous variables and percentages for the categorical. Chi-squared test was used to determine the association between of categorical variables. A value of $p > 0.05$ was accepted as statistically significant.

3.9 Ethical Consideration

For ethical consideration, ethical approvals obtained from the scientific committee in the faculty of medical sciences, 21University. Data collectors explained the purpose of the study to the surgery department, that data obtained in the study fully confidentiality of patients were protected only research team members can assess the data. All the data published only for the purpose of knowledge.

CHAPTER 4:

RESULTS

About 110 patients had undergone LC over a period of 12 months. Among them 4 patients were converted to OC with rate of 3.64%. We found 9 patients were male in rate of 8.2% and 101 patients were female in rate of 91.8% in which 4 of them had converted into OC with rate of 3.96% with p value of 0.370, this factor had no statistical significant (table 1).

Among of 110 patients we found 75 patients with body mass index was less than 25 in rate of 68.2% while 35 patients had body mass index more than 25 in rate of 31.8% in which 4 of them were converted to OC with rate of 11.4%, with p value of >0.05, and obesity increased the chance of conversion but had no statistical significant (table 1).

Table 1 : Distribution of The Characteristic of The Participants Underwent Laparoscopy.

demographic variables	Variable	study sample (n=110		X^2	p.value
		No	%		
Gender	Male	9	8.2	.985	.370[a]
	Female	101	91.8		
Body Mass Index	<25	75	68.2	.000	45.861[a]
	25-27.5	30	27.3		
	>27.5	5	4.5		
Diagnosis	Acute cholecystitis	24	21.8	.813	4.468[a]
	chronic cholecystitis	83	75.5		
Age	less 30 years	87	79.1	.210	10.856[a]
	30-40	8	7.3		
	more than 40 years	15	13.6		

According to the chronicity 24 patients had acute cholecystitis in rate of 21.8% while 86 patients had chronic Cholecystitis in rate of 78.2% and 4 patients who had chronic Cholecystitis were converted into OC with p value of >0.05, so this factor had no statistical significant (table 1).

On analyzing the age, 87 patients were less than 30 years in rate of 79.1% and 8 patients were between 30 -40 years in rate of 7.3% and 15 patients were above 40 years in rate of 13.6% and all the converted patients were above 40 years with p value of >0.05, and this factor had no statistical significant. The CR was 26.7% in the older age group (table 1).

In assessment of the incidence of abdominal injuries associated with underwent laparoscopy, bile duct injury occured in 8 patients in rate of 7.3% with p value of 0.03, followed by fibrosis of calot's triangle which occured in 3 patients in rate of 2.7% with p value of 0.015, both factors had statistical significant. Also intra-operative hemorrhage occured in 3 patients in rate of 2.7% with p value of 0.159, and this factor had no statistical significant (table 2).

Table2: The Assessment of The Incidence of Abdominal Injuries Associated

Question	Yes		No		p.value	X^2
	Fre	%	Fre	%		
Intraoperative hemorrhage	3	2.7	10	97.3%	.159	2.761[a]
intestinal injuries	0	0.0	11	100.0 %		
Bile duct injures	8	7.3	10	92.7%	.003	11.161 [a]
fibrosis of calot triangle	3	2.7	10	97.3%	.015	9.032[a]
cholecystodental fistula	0	0.0	11	100.0		

				%		
other injures	1	.9%	10	99.1%		

Table 3: Incidence of Abdominal Injuries Associated With The Converted Cases.

	Yes		No		Total	
	Count	Table N %	Count	Table N %	Mean	SD
Intraoperative hemorrhage	1	25.0%	3	75.0%	1.75	.50
intestinal injuries	0	0.0%	4	100.0%	2.00	.00
Bile duct injures	2	50.0%	2	50.0%	1.50	.58
fibrosis of calot triangle	0	0.0%	4	100.0%	2.00	.00
cholecystodental fistula	0	0.0%	4	100.0%	2.00	.00
Other injures	0	0.0%	4	100.0%	2.00	.00

In assessment of the incidence of abdominal injuries associated with the 4 converted cases we found that the bile duct injury occurred in 2 cases of them in rate of 50% with arithmetic mean of (1.50) and SD (0.58), followed by intra operative hemorrhage in one case at rate of 25% with arithmetic mean of (1.75) and SD of (.50) also the results showed that there was no injury to intestines and calot triangle and no cholecystoduodenal fistula (table 3).

On analyzing the other difficulties facing by the surgeons during the laparoscopic procedure we found that the bleeding came in the first place as it occurred in all of the cases that underwent LC in which of them 106 cases had mild bleeding in rate of 96.4% and 4 cases had moderate bleeding in rate of 3.6% and both (mild and moderate bleeding) had statistical significant as they had p value of 0.0001, followed by adhesion that occurred in 28 cases in rate of 25.5% with p value of 1.000, and there was no associated technical error recorded (table 4).

Table 4: Difficulties Facing Our Surgeon During The Procedure.

Question	variable	Fre	%	S. D	Mean	p.value	X^2
Bleeding	Mild	106	96.4	.18	1.03	.000	26.810[a]
	moderate	4	3.6				
Abdominal adhesion	Yes	28	25.5	.44	.10	1.000	.038[a]
	No	82	74.5				
Technical error	Yes	1	0.9	1.75	1.99		
	No	109	99.1				

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Also when we analyzed the frequency of conversion according to the surgeons' experience we found that 103 cases were done by higher experienced surgeons in rate of 93.6% in which 4 of them were converted to OC and 7 cases were done by inexperienced surgeons with rate of 6.4%, with an arithmetic mean of (1.06) and a SD of (.245) (table 5).

Table 5 : Frequency of Conversion According The Surgeon Experience.

Surgeon Experiences			Mean	S. D
Percent	Frequency	Variable		
93.6	103	Yes	1.06	.245
6.4	7	No		
100.0	110	Total		

Analyzing the relationship between age and gender and the causes of converted cases we found that 2 cases occurred at the same age of 60 years which caused by adhesion with GB mucocele and large stone difficult to extract by laparoscopy with GB hydrops, while the other cases which caused by distorted anatomy of the GB with injury of CBD and adhesion with retraction of GB to the diaphragm occurred at the age of 45 & 47 years respectively , so the old age increase the risk for laparoscopic conversion to OC but with no statistical significant as they had p value of 0.210, also all of the converted cases occurred in females in which the female gender is a high risk for laparoscopic conversion to OC (table 6&7).

Table 6: Cuases of Conversion In Relation to Age.

The causes of conversion			Age			Total		
			from 14 – 30	from 31 – 50	more than 51		X^2	P.Value
Other Difficult	distorted anatomy of G.B and injury of CBD	Count	1	0	0	1	10.856[a]	.210
		% of Total	25.0%	0.0%	0.0%	25.0%		
	G.B.Mucocele with server adhesion	Count	0	0	1	1		
		% of Total	0.0%	0.0%	25.0%	25.0%		
	large stone difficult to extract by laparoscopic hydrops GB	Count	0	0	1	1		
		% of Total	0.0%	0.0%	25.0%	25.0%		

	retraction of G.B to the diaphragm	Count	0	1	0	1		
		% of Total	0.0%	25.0%	0.0%	25.0%		
Total		Count	1	1	2	4		
		% of Total	25.0%	25.0%	50.0%	100.0%		

At the end we found that the most common cause of laparoscopic conversion into OC was adhesion as it seen in 50% of converted cases while 25% caused by large stone difficult to extract by laparoscopy with hydrops GB and 25% was due to distorted anatomy of GB & injury of the CBD.

Table 7: Cuases of Conversion in Relation to Gender

The causes of conversion		Gender		Total	
		female			
		Count	% of Total	Count	% of Total
Other Difficult	distorted anatomy of G.B and injury of CBD	1	25.0%	1	25.0%
	G.B.Mucocele with server adhesion	1	25.0%	1	25.0%
	large stone difficult to extract by laparoscopic hydrops GB	1	25.0%	1	25.0%
	retraction of G.B to the diaphragm	1	25.0%	1	25.0%
Total		4	100.0%	4	100.0%

Final Results:

1. The result concluded that the rate of conversion was 3.64%, and the most common cause of conversion was adhesion.

2. Patient Related Factors - Age >40 years, female gender, obesity and chronic Cholecystitis were found to be significant pre-operative risk factors in conversion of laparoscopic to OC, but all of those demographic variables had no statistical significant as they had p value of>0.05.

3. Bile duct injury and fibrosis of calot's triangle both had statistical significant as they had p value of 0.003 and 0.015 respectively, while intra-operative hemorrhage had no statistical significant as it had p value of 0.159, and all of them were intra-operative risk factors for the conversion from LC into OC.

4. The results concluded that the difficulties encountered by the surgeons during the endoscopy were the lightest bleeding with a high rate, followed by abdominal adhesion, and the technical error was the least among the difficulties faced by the surgeons.

5. The result concluded that the causes of the conversion were adhesion with GB mucocele, large stone difficult to extract by laparoscopy with GB hydrops, distorted anatomy of the GB with injury of CBD and adhesion with retraction of GB to the diaphragm.

6. The results concluded that mild bleeding and abdominal adhesion are among the most common causes of converted and open cases, and the results also showed that no technical error was recorded.

CHAPTER 5:

DISCUSSION

LC has become the procedure of choice for management of symptomatic GB stone disease. However, the risk of conversion to open surgery is always present. The actual rates of conversion reported in literatures are 3.6%. Conversion from laparoscopic to OC is required when safe completion of the laparoscopic procedure can not be ensured. It is considered as a sound judgment rather than failure of laparoscopic surgery to avoid complications and reduce morbidity. The identification of parameters predicting conversion helps in pre-operative patient counseling provides for better pre-operative planning and avoids laparoscopy associated complications by converting to open procedure as and when appropriate. In our study it has been observed that Patient Related Factors - Age >40 years, female gender, obesity and chronic Cholecystitis were found to be significant pre-operative risk factors in conversion of laparoscopic to OC. Also bile duct injury and intra operative hemorrhage were intra-operative risk factors in conversion of laparoscopic to OC.

Similar to our study, In USA a study showed that the overall CR was 4.9%. The most common reason for conversion was adhesions, and the majority of these patients had prior abdominal surgery. Patient >50 years old had a significantly higher likelihood of open conversion. CRs were lower among surgeons with fellowship training and those who completed residency training after 1990. Interestingly, the percentage of conversions due to technical difficulty was lower among those with fellowship training but higher among those who complete d training after 1990 (Sujit Vijay Sakpal, et al, 2010).

The study in British showed that rate of conversion to OC was 3.4% in 8820 patients with Mean patient age was 51 ± 17 years and 73.9% were female. The specific indications for conversion were not collected prospectively in the CholeS study protocol, bile duct injury (N = 7) bowel injury (N = 12) and bleeding (N = 64) were observed in 83 out of 297 (28%) converted patients. Of the remainder, operative difficulty was graded 3 or 4 in 170 (57%), and 35 patients (12%) underwent bile duct exploration. The reason for conversion was unclear in 9 patients (3%) (Robert P. Suticlifffe, et al, 2016).

In Indian study showed rate of conversion to OC was 7% in 100 patients, which were 12 of them males while 88 of them were females. The intra-operative factors responsible for conversion in all the cases were evaluated. Adhesions were seen in 33 out of 100 cases but were dense enough to lead to conversion to OC in 5 of those (15.15%). Anatomy at Calot's triangle was obscured in 6 out of 100 cases. Bleeding severe enough to obscure vision and that could not be laparoscopically controlled was seen in only 1 case (Anam Saeed, et al, 2020).

Iraq study Showed that from 150 patients who underwent LC 25 patients were males (16.66%) and 125 patients were females (83. 33%).Nine conversions were obtained (CR was 6%). The most common cause of conversion was disturbed anatomy due to dense adhesions (RafeaJasim Hussein Al-Shammari, et al, 2018).

Egypt study showed the reasons for conversion of 234 (5.3%) of the patients scheduled forLC in the study period.There were 115 (49.1%) males and 119 (50.5%) females, and the most common cause of conversion was dense pericholecystic adhesions in rate of 54.7%, followed by inability to accurately define the biliary anatomy in rate of 21.4% (Ayman El Nakeeb, et al, 2013).

Previous Yemen study attempted in 709 patients at Kuwait University hospital in Sana'a, there were 91.4% women and 8.6% menwith mean age of 38 years (Range 14 to 86 years), the most common cause of conversion was adhesion with rate of 8.3% (Saeed Hadi Al-Bahlooli, et al, 2009).

This preoperative prediction of risk factors may help surgeon to prepare better for intra-operative technical difficulties expected to be encountered and to make an early decision to convert, if dissection seems to be very difficult and non-progressive, to prevent unwanted biliary tract injuries and complication.

CHAPTER 6:

CONCLUSION

In conclusion, patient Related factors- Age >40 years, Female gender, Obesity and Chronic cholecystitis were found to be significant pre-operative risk factors in conversion of laparoscopic into OC.

None of these factors assessed were contraindication to LC, but they may help to predict the difficulty of the procedure, and this would permit the inform the patients about the risk of conversion from laparoscopic to OC.

Bile duct injury and fibrosis of calot's triangle both had statistical significant, while intra-operative hemorrhage had no statistical significant and all of them were intra-operative risk factors for the conversion from LC into OC.

The decision about when to convert toOC is made by the surgeons during the course of the procedure on the individual and often subjective basis. Need to convert is neither a failure nor a complication, but an attempt to avoid complication.

CHAPTER 7:

RECOMMENDATION

Because prevention is better than treatment, prevention of cholecystitis is possible and is done by lose weight slowly. Rapid weight loss can increase the risk of gallstones.

To achieve a healthy weight, the patient must to take a healthy diet which is high in fruits, vegetables and whole grains, also reduce calories and increase physical activity. Maintain a healthy weight by continuing to eat well and exercise.

Enhanced preoperative imaging and assessment implement a comprehensive preoperative imaging and assessment protocol for patients with suspected adhesion large stone hydrops GB, and abnormal anatomy. This include high resolution ultrasound, magnetic resonance (MRCP), and computed tomography (CT) scan. Accurate preoperative assessment can aid in identifying potential anatomical variations, and GB distention., enabling surgeons to better plan and anticipate challenges during the laparoscopic procedure.

Surgeon training and experience

The experience of the surgeon is important to know from the beginning whether this patient needs laparoscopic removal of the GB or if it is an open operation and during the operation to avoid injury to the abdominal organs, blood vessels or nerves.

Therefore, promote specialized training programs and continuous professional development opportunities for surgeons performing LC. This training should focus on advanced laparoscopic techniques including strategies for handling adhesion, managing large stone hydrops GB, and addressing anatomical complexities. By improving surgeon's technical skills and familiarity with challenging cases, the likelihood of converting to an open procedure can be minimized.

Multidisciplinary Approach

Encourage a multidisciplinary approach to challenging LC cases. Establish a platform for collaboration between surgeons, radiologists, gastroenterologists, and anesthesiologists to discuss complex cases preoperatively. This multidisciplinary team can collectively review imaging studies, assess risks, and develop tailored strategies to optimize the laparoscopic approach, therapy minimizing the need for conversion.

Standardized surgical protocol

Develop standardized surgical protocol for LC that incorporate best practice for managing adhesion, large stone hydrops GB, abnormal anatomy,this protocol should be outline step-by-step guidance on techniques such as gentle dissection, appropriate use of adhesiolysis, safe stone extraction, and adapting on anatomical variation. By adopting standardized protocol, surgeons can enhance their efficiency and decision-making during laparoscopic procedure, reducing the CR. These recommendations are grounded in current evidence-based practices and clinical experiences.

Implementation of these strategies has the potential to significantly decrease the CR of LC to OC in cases involving adhesion, large stone hydrops GB and abnormal anatomy.

By integrating these strategies, we can improve patient outcomes, reduce surgical complications, and enhance the overall success of LC.

APPENDIX

APPENDIX A: AL-THAWRA HOSPITAL ETHICAL APPROVAL

الجمهورية اليمنية
هيئة مستشفى الثورة العام – صنعاء
الشؤون الاكاديمية والتدريب
قسم البحوث والنشر

الشؤون الأكاديمية والتدريب

تعـهد

أنا الباحث/ الباحثون من جامعة ٢١ سبتمبر

أتعهد/نتعهد بإعطاء نسخة ورقية (مجلدة) ونسخة الكترونيه (PDF) من بحث التخرج المعنون: (السبب في تغيير إزالة المرارة بالمنظار إلى عملية مفتوحة في مستشفى الثورة)

إلى قسم البحوث والنشر بأكاديمية هيئة مستشفى الثورة العام- صنعاء لغرض التوثيق والحفظ بعد الانتهاء من تجهيز التقرير النهائي للبحث وفي حال عدم احضار نسخه البحث يحق للقسم مطالبة الجهة المرسل منها الباحث والباحث نفسه ، بطريقة قانونية.

التأريخ: ١١ / ٢ / ٢٠٢٣م.

أسم الباحث/ الباحثون: جامعة ٢١ سبتمبر

أولهم: محبوب علي احمد الحبر التوقيع:

وأخرهم: مصطفى محمود بهدي الاحمد التوقيع:

وقع عنهم: التوقيع:

رقم الهاتف: 773 876 879

توقيع وختم الجهة المرسل منها

APPENDIX B: QUESTIONNARE

Republic of Yemen
Ministry of Higher Education & Scientific Research
21 September University of Medical and Applied Sciences
Faculty of Medicine and Health Sciences

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
جامعة 21 سبتمبر للعلوم الطبية والتطبيقية
كلية الطب البشري

Questioner

No_____

- full Name : ☐
- Age : ☐
- Gender : Male. ☐ Female. ☐
- Obesity : Mild. ☐ moderate. ☐ severe. ☐
- Diagnosis :Acute cholecystitis: ☐ duration ☐ days.
  Chronic cholecystitis; ☐
- Biliary tract pathology : ☐
- Characteristic of participants : ☐
- Surgeon experienced : YES. ☐ NO. ☐

APPENDIX B: QUESTIONNARE

Republic of Yemen
Ministry of Higher Education & Scientific Research
21 September University of Medical and Applied Sciences
Faculty of Medicine and Health Sciences

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
جامعة 21 سبتمبر للعلوم الطبية والتطبيقية
كلية الطب البشري

- Duration of laparoscopy :

- Abdominal injury association :

- Intraoperative hemorrhage : YES. ☐ NO. ☐
- Intestinal injuries : YES. ☐ NO. ☐
- Bile duct injury : YES. ☐ NO. ☐
- Fibrosis of calot triangle : YES. ☐ NO. ☐
- Cholecystoduodenal fistula : YES. ☐ NO. ☐
- Other injuries : YES. ☐ NO. ☐

- Difficulties facing our surgeons during procedure:
  - Bleeding : mild. ☐ moderate . ☐ severe. ☐
  - Abdomenal adhesion: YES. ☐ NO. ☐
  - Technical error : YES. ☐ NO. ☐
  - Other difficulties :

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