SIGNIFICANCE OF ROBOTIC CHOLECYSTECTOMY OVER LAPAROSCOPIC CHOLECYSTECTOMY IN THE MANAGEMENT OF CHOLECYSTITIS: A CASE STUDY OF FACTORS INFLUENCING PATIENTS' DECISION AT A HOSPITAL IN TEXAS, USA

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Abstract

The increasing cases of cholecystitis (gallbladder inflammation) among the patient population call for more corrective measures to improve clinical outcomes. Notably, LC (laparoscopic cholecystectomy) was the standard surgical procedure for managing gallbladder ailment. However, with technological advancement, a robotic-aided technique (robotic cholecystectomy) was introduced based on the idea that it improves on some of the shortcomings associated with LC. Notably, RC involves a single incision, hence, it is less invasive than LC. The research objectives aim at establishing the RC's clinical significance over LC. It also analyzes the factors that inform patients' decisions regarding their preferred cholecystitis management procedure. A literature review of the current scholarly information on the subject was conducted to gather insights that somehow informed the study. The researchers employed a descriptive and explanatory research design based on mixed methods (quantitative and qualitative ones). Besides, the target population for this study was selected from Memorial Hermann Hospital in Houston, Texas. Although the scholars had projected a 292 sample size based on the Yamane formula, they gathered 350 voluntary participants comprising 250 cholecystitis patients and 100 surgical unit healthcare professionals. The data collection tools included surveys and interviews. The collected information was analyzed using MS Excel and SPSS statistical tools. The findings showed that cholecystitis patients analyzed factors such as the degree of pain, cost, postoperative complications, operation duration, scarring, and recuperation rate before making decisions. RC proved to have more benefits than LC. However, LC was still preferred in some cases because it is cheaper and takes less surgical time.

Keywords: *Cholecystectomy, Cholecystitis, Incision, Laparoscopic, Robotic.*

1. INTRODUCTION

Fundamentally, cholecystitis is a gallbladder inflammation ailment that arises when gallstones (solid material lumps comprising bilirubin and cholesterol) block the bile discharge

tube, causing the swelling. According to the John Hopkins medical institution, cholecystitis could also be caused by the bile duct system bacterial infection, liver and pancreas tumors, blood supply reduction, and gallbladder sludge (Huang et al., 2017). According to research studies, the disease prevalence rate is gradually rising as more people adopt unhealthy dietary plans, which affect their gall bladder functionality. Besides, populations with preexisting conditions such as HIV and diabetes mellitus predominantly suffer from cholecystitis. Clinical reports show that individuals suffering from the disease show symptoms like belly bloating, jaundice, sharp pains, fever, vomiting, and nausea. Worrisomely, studies depict that the condition's hospital admission rates are the highest among gastrointestinal problems. This means that the ailment cost burden is continuously rising, thus, burdening families and the healthcare system. Studies have also shown that late diagnosis of cholecystitis contributes to multiple deaths worldwide.

Depending on the severity, a patient's clinical manifestations can be categorized as acute or chronic cholecystitis. Several treatment methods exist for the former (acute) and latter (chronic). These include medication, drainage tube insertion, oral dissolution therapy, and surgery. Amongst various therapeutic approaches, a surgical procedure known as cholecystectomy is the most preferred one, especially for individuals with chronic cholecystitis. Cholecystectomy involves surgically removing the inflamed gallbladder. Scholarly works depict that cholecystectomy has developed over the years, with different types often arising. The notable procedures include OC (Open Cholecystectomy), LC (Laparoscopic Cholecystectomy), and RC (Robotic Cholecystectomy). According to scholars, LC has been the most common in the last few years. For instance, medical reports show that nearly 400,000 LCs were done in 2010 (Gutt et al., 2020). Analytically, LC's high preference in the past decade is attributable to its consideration as gallstone's disease standard operative care since the 90s. However, in recent years, the medical fraternity has slowly shifted its focus to RC. Robotic surgeries have increasingly gained popularity in surgical operations as they are believed to have numerous advantages over traditional methods. The notable benefits include fewer infection risks, significantly reduced post-surgery pain, 3D (three-dimensional) view (offering a grander movement degree), and precise dissection due to improved instrument articulation (Lee et al., 2017). In this regard, more surgeons are progressively choosing RC over LC in managing cholecystitis. As such, the scholarly focus has shifted towards critically analyzing the viability of incorporating RC in identified patient populations' cholecystitis management.

1.1 Purpose of the Study

Primarily, this study aims at contextualizing RC's clinical significance in cholecystitis management compared to LC. Considering that RC incorporation in gastrointestinal problems and surgical procedures mainly began in the last decade, scholars seek to conduct more studies to develop more supportive evidence in favor of RC. Notably, there is little documented proof of RC's success since robotic technology incorporation in the medical field is relatively recent. Besides, the research intends to explore various ways in which RC mitigates the problems associated with LC to enhance quality care provision to cholecystitis patients.

1.2 Research Objectives

The main objective of this is to determine RC's clinical advantages over LC in cholecystitis management. The goal enables the researcher to examine its significance and practicality. When establishing the benefits, the partaker must critically assess the pros and cons that each method (LC or RC) presents. Secondly, the study will explore various factors of the treatment approach that influence patients' decisions regarding cholecystitis management. It is also imperative to compare RC and LC treatment outcomes in the identified population.

1.3 Scope and Significance

Research studies indicate that approximately 10-15% of the US populace have gallstones. According to NIDDK (*National Institute of Diabetes and Digestive and Kidney Diseases*), 25% of the said population requires surgical cholecystitis treatment yearly (Huang et al., 2017). The disease is among the "silent" but lethal ailments affecting individuals. Although there are several cholecystitis management practices, this study will focus on LC and RC, whereby the former is regarded as the traditional method and the latter as the modern approach. Due to its high prevalence in the US, the sample population will be obtained from Houston, Texas, healthcare facilities offering cholecystectomy procedures. Markedly, the selected location is suitable as it is easily accessible, streamlining data collection and follow-ups. The specific hospital that the researcher selected is MHHS (Memorial Hermann Hospital System), which is believed to record about 64 weekly patient visits that require cholecystectomy services. This research will assess one-year data that could reflect 768 patients. More information about the cholecystitis victims will be gathered from about 100 family members and 80 healthcare providers attached to the surgical unit. As such, the population size under study adds up to 948 participants. Notably, the researchers will further incorporate the Yamane formula (n= N/ (1+N (e) 2) to compute the SS (sample size). The resultant SS will be 292, factoring in a 0.05 error.

Analytically, comparing RC and LC is highly significant since the results will inform medical decision making regarding cholecystitis management. Notably, WHO (World Health Organization) and Healthy People 2020 recommend developing and adopting disease control strategies that could enhance patients' life quality and reduce the burden of illnesses. In this regard, this study is substantial as it will offer invaluable insights into the most viable and realistic surgical approach for managing cholecystitis. Essentially, should policymakers, patients, and healthcare providers support this study's hypothesis (that RC is more advantageous compared to LC), hospitals offering cholecystectomy will undoubtedly witness a significantly reduced rate of postoperative complications. Consequently, patients will recuperate faster and regain normalcy. Besides, scholarly works suggest that proper cholecystitis control lowers the likelihood of contracting liver-related diseases like cirrhosis and hepatitis. Additionally, investigations on RC significance augment the scientific knowledge that would inform evidence-based practice and serve as a scholarly resource for future studies.

1.4 Conceptual Framework

Figure 1 below illustrates the conceptual framework guiding this report’s structure and depicts the existing relationship between the variables. It also informs readers how various research processes will be put together to achieve the desired objectives.

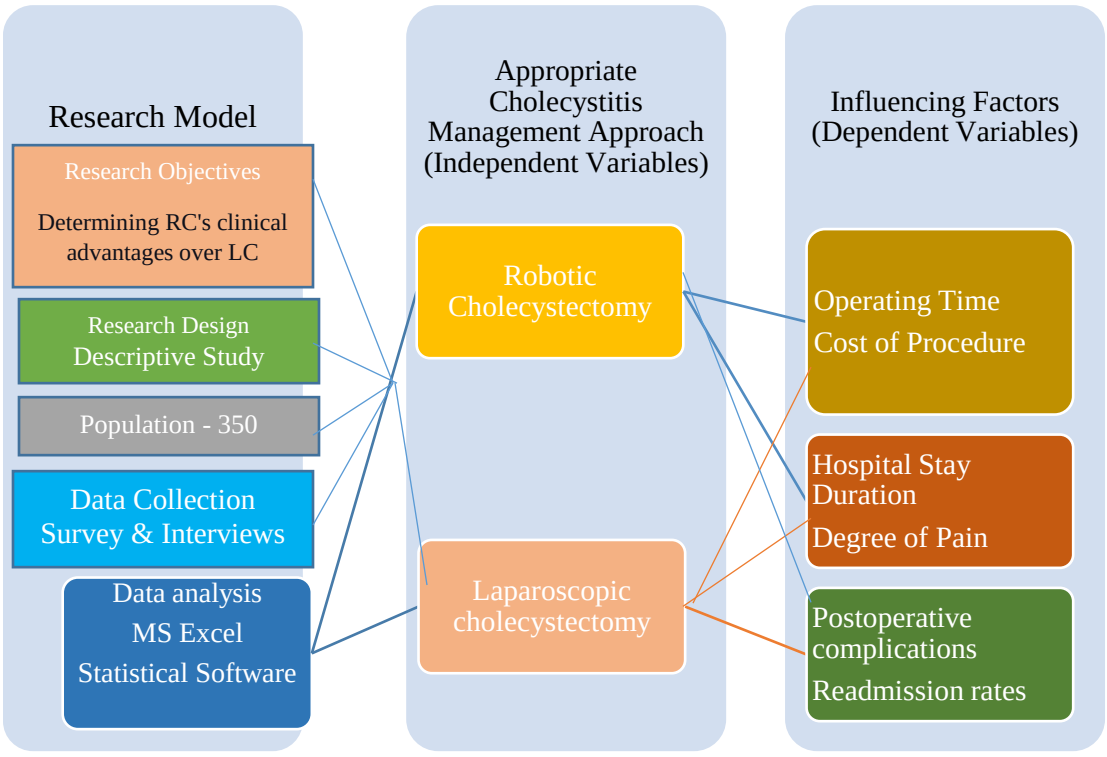

Figure 1: The Conceptual Framework

1.5 Definition of Terms

The study will repeatedly use several terms to explain the theoretical model of research. Providing their definition helps readers comprehend their meaning.

- **Gall bladder** - a small organ in the body, found beneath the liver. It is sac-shaped and stores liver secretion (bile) before releasing it.

- **Cholecystitis** - a gallbladder inflammation disease. It occurs when the cystic duct (a passageway for bile) is blocked by gallstones. The condition's severity increases when destructive microorganisms begin perforating walls in the swollen region.
- **Cholecystectomy** - this is a common medical term referring to the surgical procedure for removing the gall bladder.
- **Incision** - a cut made on the flesh when one is performing surgery.
- **Robots** - machines with the ability to execute human functions.
- **Robotic Cholecystectomy** - a type of surgery in which surgeons employ robotic technology to remove inflamed gall bladders.
- **Laparoscopy** - is a diagnostic surgical procedure that employs a thin tube fiber-optic tool (laparoscope) that enables surgeons to view and diagnose internal abdominal organs as well as perform surgery to remove damaged tissues.
- **Laparoscopic Cholecystectomy** - a gall bladder removal surgery that involves laparoscopy.

2. LITERATURE REVIEW

2.1 Cholecystitis and its Management History

According to scholarly works, cholecystitis management has gradually evolved since its first occurrence in 1500 BCE (Huang et al., 2017). Eachempati and Reed (2015) assert that the ultrasonography and HIDA (hepatobiliary Iminodiacetic Acid) scan method were among the earliest treatment approaches employed in managing gall bladder disease. The former was used in testing gallbladder disease through gallstone detection. It (ultrasonography) is inexpensive, noninvasive, specific, and very sensitive, with up to a 95% success rate. As such, ultrasonography was termed the "method of choice" for detecting gallstones with a narrow negativity rate (Bortoff et al., 2000). The latter (HIDA) majorly checks gallbladder functionality. Research studies indicate that HIDA involves injecting a radioactive tracer (RT) into the patient's arm vein. The RT will travel to the liver via the bloodstream, get infused in the bile producers, and then through the bile ducts, get to the gall bladder. However, it emerged that HIDA scan exposed patients to radiation (thanks to the radioactive tracer) and could also bruise the affected site.

Nevertheless, it was believed to have a 77% sensitivity and specificity rate. Studies depict that the medics later adopted the use of computed tomography, which had a 97% success rate. Severe abdominal pain was managed using plain abdominal radiography (PAR). However, according to the NCBI (National Center for Biotechnology Information), PAR specificity and sensitivity percentage are so low that they could be entirely included in cholecystitis patients' workup plans (Gans et al., 2012). Eachempati and Reed (2015) state that medics adopted ERCP (endoscopic retrograde cholangiopancreatography) as the better option for managing cholecystitis. Essentially, ERCP involves examining the bile and pancreatic duct and gall bladder and treating any anomalies through the combination of x-rays and gastrointestinal endoscopy (Burstow et al., 2015).

Although the abovementioned procedures aided in managing gallstones, they did not permanently cure the patient. Research studies indicate that the first cholecystectomy-like

surgical procedure was accomplished in 1676. The operation known as cholecystolithotomy involved a gallbladder incision to remove gallstones (Strosberg et al., 2017). The surgery was performed by Joenisius, who successfully extruded gallstones from the biliary fistula's abdominal wall (AW). However, according to other scholars, the transabdominal incisions incorporated when carrying out cholecystolithotomy were perilous, mainly in the event that the AW and bladder are not adjacent. To reduce the risk, gastroenterologists and surgeons opted to use caustic potash (potassium hydroxide) as a scarring stimulator for a downward AW cut toward the peritoneum. Adhesions would form, allowing the medics to perform gallbladder aspiration (Eachempati & Reed, 2015). This procedure is believed to have significantly aided in symptomatic cholelithiasis treatment.

Furthermore, studies depict that the 20th century was characterized by several technological advancements that were then reflected in cholecystitis management. Essentially, the innovation of IR (Imaging Radiography) enabled gallstone imaging, but the procedure was relatively ineffective (Burstow et al., 2015). Later, in the 1980s, medical researchers successfully developed PTC (percutaneous transhepatic cholangiogram) that was used to evaluate the biliary tract obstructions by injecting contrast material into the bile ducts (Eachempati & Reed, 2015). Further advancements led to the gray-scale ultra-sound introduction, which improved gallstone screening as the improvements provided enhanced beam focus, higher resolution, and real-time sonography (Alkarboly et al., 2016). It is also worth noting that thousands of open cholecystectomies, which involve the right side abdominal incision and tissue and muscle pulling to enable gallbladder removal, were carried out (Jones et al., 2021) in several surgical centers worldwide till the late 1980s. According to research studies, the OC procedures were reasonably practical as they were above averagely successful. If anything, research studies indicate that less than 0.1% of OC-related deaths were witnessed. However, Eachempati and Reed (2015) assert that the subcostal incision method that surgeons utilized in OC procedures were accompanied by excruciating pain. Besides, the operation could lead to substantial morbidity and pulmonary dysfunction. Also, due to the agony and discomfort associated with OC, patients had to have more than two days' postoperative hospital stay. Nonetheless, most of the problems experienced in the outlined cholecystitis management procedures were significantly reduced upon the introduction of LC in the 1990s.

2.2 Laparoscopic Cholecystectomy (LC)

Fundamentally, laparoscopy is an invasive medical procedure employed in examining internal abdominal organs. Cholecystectomy refers to the abstraction of defective gallbladders from individuals suffering from cholecystitis. Research studies indicate that LC became cholecystectomy's gold standard upon its inception in the 1990s. LC involves the insertion of special surgical tools and a laparoscope (small video camera bearing tube) into the cholecystitis patient's abdomen via four tiny incisions. The laparoscope displays the gallbladder on the monitor, guiding the surgeon to skillfully remove the gallbladder through a small slit (incision) (Hassler et al., 2021). Scholarly works further indicate that LC has also been extensively used in treating biliary dyskinesia, symptomatic and acute cholelithiasis, gallstone pancreatitis, acalculous cholecystitis, and gallbladder polyps (Jones et al., 2021).

According to Hassler et al. (2021), the LC technique begins with the abdomen's insufflation with 15mmHg carbon dioxide. The surgeon subsequently makes four tiny incisions (two right subcostal, one subxiphoid, and one supraumbilical) for placing trocar in the abdomen. With the long special surgical instrument and the laparoscope, the medic retracts the gallbladder over the liver, exposing the hepatocytic triangle (Hassler et al., 2021). This is followed by clearing the fatty and fibrous tissue layers to obtain a clear view of the tubular structures that make their way into the gall bladder's base. As such, the surgeon can envisage the CP (cystic plate) separately from the liver. Hassler et al. (2021) point out that the dissection ensures that the CA (cystic artery) and CD (cystic duct) are carefully isolated, clipped, and split. The surgeon subsequently uses a harmonic or electrocautery scalpel to separate the liver bed and the gallbladder, which is then removed. The abdomen should shrink to 8mmHg to achieve hemostasis. The LC procedure is illustrated in Figure 2 below.

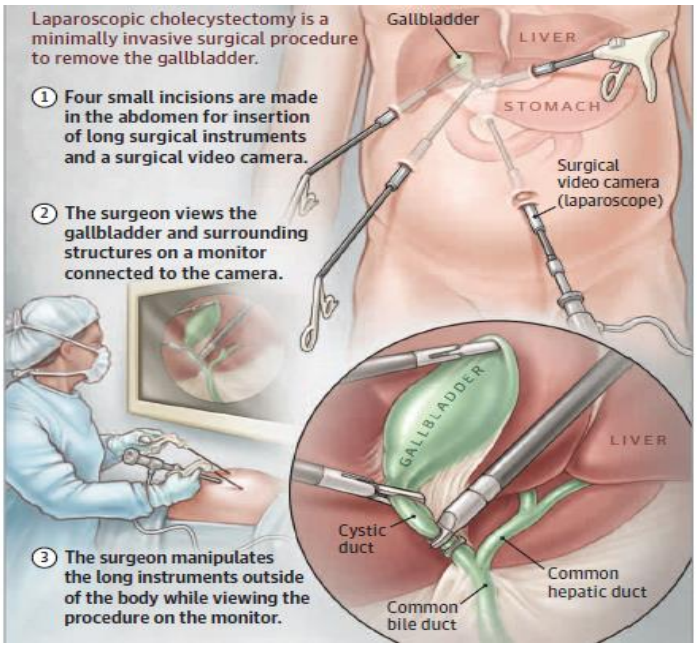

Figure 2: The Laparoscopic Cholecystectomy Surgical Process

Source: JAMA network

Analytically, although some scholars posited that LC had significantly minimized the setbacks that were witnessed in the previous cholecystitis management procedures, others maintained that the technique had unignorable setbacks. Proponents such as Jugenheimer (2009) asserted that LC has minimal invasion compared to OC. Besides, LC is associated with improving the patient's prognosis and recovery. Scholars assert that individuals undergoing LC experience bearable pain and often do not need vast doses of postoperative analgesia. Additionally, the patient hospital stay timeframe significantly shortens to less than 24 hours from nearly a week in OC (Jain et al., 2005). According to Kumar et al. (2021), the procedure (LC) heightens patient satisfaction and improves cosmetics more than OC. Markedly, LC is also cost-effective since shortening the hospitalization period may reduce the net expenditure. However, it is worth noting that other scholars contrastingly assert that gallstone disease management costs in countries such as the US skyrocketed during the laparoscopic age, perhaps since many LC surgeries were performed (Kumar et al., 2021).

Hassler et al. (2021) further point out that LC could lead to complications such as the hepatic duct or common bile iatrogenic injury. Such hitches would require additional surgery conducted by a highly experienced hepatobiliary surgeon for bile flow diversion into the intestines. According to scholars, most LC-related postoperative issues occur at the surgical tools and entry points where incisions are made. Essentially, during the invasion, surgeons were forced to cut and manipulate several tissues to access the gallbladder, often injuring the bile duct. The cholecystitis patient contracts abdominal hernia and other related complications in most instances. Despite the setbacks, scholars assert that one cannot ignore LC's substantive contribution to cholecystitis management. It had several advancements that were otherwise unachievable by using the OC approach. For instance, Al-Mulhim (2017) asserts that LC inception allowed for asymptomatic gallstone treatment, which was nonexistent in the OC era. Besides, LC enhanced the recuperation rate and reduced cholecystitis-related mortality. Essentially, a comparative study between LC and OC showed that only 0.04% of deaths were registered in the former based on data collected from 77,604 patients. In comparison, the latter had 0.17% of a sample population of 42,474 cholecystitis victims (Al-Mulhim, 2017). However, the alarming rate of bile duct complications associated with LC depicted the need for a more improved cholecystitis management approach.

2.3 Robotic Cholecystectomy

Primarily, RCs are cholecystitis managing surgical activities completed with the guidance of automated (robotic) frameworks. Notably, RC reduces the specialist work since the robotic system (RS) executes most obligations while the surgeon controls it. A direct telemanipulator or PC provides the guidelines that help the RS perform tasks. Research studies indicate that the RS utilized in RCs is outfitted with top-quality 3D cameras that project the gallbladder and regions around it with high definition and detailed views. Besides, the RS has the capacity to limit wounds, as it is outfitted with the FFI (Firefly Fluorescence Imaging) technique that permits perception way past the ability of the natural human eye (Huang et al., 2017). Scholarly works further depict that incorporating RS during RC limits scars since the surgical procedure involves a single incision.

According to Zaman and Singh (2018), RC was developed as a measure for countering the limitations witnessed in LC. During its inception, the medical fraternity was skeptical about putting robotic-aided surgery into clinical practice. The scholars assert that the first batches of robotic surgical systems were not universally acknowledged. Essentially, their extensive acceptance in surgical procedures was only after FDA (the Food and Drug Administration) approved *Intuitive Surgical, Sunnyvale, CA, USA, a da Vinci® telesurgical robotic system* in 2000. Studies depict that the da Vinci RS-powered surgical device was mainly created to be less intrusive and improve on other LC downsides. It (da Vinci system) enables SSRC (*single-site robotic cholecystectomy*) and MPRC (*multi-port robotic cholecystectomy*) (Zaman & Singh, 2018). SSRC procedure involves using an explicitly designed and bent cannula, docked to the robotic arms to achieve adaptable instrumentation that permits triangulation. As such, the specialist has a well-defined surgical field and can execute the operation from both the left- and right-handed RS arrangement.

Zaman and Singh (2018) assert that the RS instrument location is automatically corrected in this robotic-enabled platform. Besides, when IGC (Indocyanine Green Cholangiography) is present, the surgeon can employ the 3D visual camera framework. Lee et al. (2017) state that SSRC has several advantages comprising minor bleeding and pain, insignificant scarring, and reduced hospitalization period. According to these scholars, the lesser ache and sting in SSRC gives it a significant advantage over LC, which is often 3-ported. Markedly, excruciating agony after an operation is least desired among patient populations. As such, any procedure likely to minimize pain will be the most preferred, especially in the instances where the physician candidly explains to their client the level of discomfort in each approach. Additionally, SSRC is believed to have minimal postoperative complications cases, unlike LC, often associated with bile duct injuries.

On the other hand, MPRC robotic port (RP) placement depends on the surgeon's preferences, just like in LC. Nevertheless, to give the articulating instruments a free ROM (range of motion), the specialist must ensure that the RS is maintained at a distance of 8 to 10 centimeters from the surgical site. Since MPRC uses about three to four RPs, it is vital to place them equidistantly to avoid instrument collision. Scholars assert that it would be more cost-effective if the surgeons minimized tool exchanges (Lee et al., 2017). Essentially, they (surgeons) may utilize hook cautery to suture, clip, staple, or ligate the cystic duct. Besides, IGC could be used in imaging the portal system. Studies further depict that the 3D visualization in RC lessens target anatomy confusion as it improves the surgeon's capacity to identify objects distinctly (Zaman & Singh, 2018). An example of RC utilization is as depicted in Figure 3 below.

Figure 3: Robotic Cholecystectomy Surgical Process

Source: (Liu et al. 2017)

Notably, the RS used in RC had improved electronic executions and amplification and developed ergonomics to suit the surgeon's needs during the procedure. Besides, its enhanced instrumental finesse is more flexible, providing seven degrees of motion, compared to four in LC. It is worth noting that RC is not entirely accomplished robotically; instead, the surgeon tele-surgically controls RS arms (that contain the camera) using a console placed at a small distance from the operating table, where the patient is lying. As such, RCs are regarded as CAS (computer-aided systems). The surgeon and the OR (operating room) members must take a few technical lessons to acquaint themselves with the RC procedure (Zaman & Singh, 2018). According to Kane et al. (2020), RC majorly offers technical advantages over LC. In essence, it allows for the biliary system's intraoperative biliary imaging and offers improved instrument articulation, diminished conversion rates, and enhanced precision and cosmetics. However, the scholars further assert that RC's disadvantages include high operative costs and extended timeframes compared to LC (Kane et al., 2020).

To substantiate these claims, Kane et al. (2020) conducted a study to compare the success rate of RC and LC. The researchers utilized a sample size of 3,255 patients that had been prescribed to undergo cholecystectomy. They compared the clinical outcomes of individuals who chose RC and LC. Majorly, the scholars analyzed the hospital cost, stay duration, operative time, postoperative complications, and the readmissions rates (30- and 90-day ones). Notably, scholars incorporated Chi-square test and the Mann-Whitney U tool in comparing categorical and continuous variables. Out of the 3,255 patients, 106 opted for RC, while 3,149 chose LC. It emerged that those patients who selected RC had a shorter hospital stay and later recorded minimal 90-day readmission compared to their counterparts who underwent LC (Kane et al., 2020). However, the RC patients spend more money. As such, Kane et al. (2020) concluded that RC significantly improves cholecystitis management clinical outcomes, hence, it is better than LC. Nevertheless, the scholars suggested that there is a need to innovate an improved RS version that could minimize the time and cost utilized in performing RC.

2.4 Robotic Cholecystectomy Patient's Prognosis

According to scholarly works, present-day RC has significantly enhanced patient outcomes more than LC and other traditional cholecystitis management approaches. Milone et al. (2019) state that the da Vinci RS used in RCs is safe and feasible for managing ACC (acute calculous cholecystitis). Essentially, the approach has lesser conversion rates, hence, it best suits patients requiring intraoperative procedures. In their study, Milone et al. (2019) found that several individuals from their sample size had perforated and empyematous cholecystitis following a histopathological examination. The sick persons underwent RC as the critical intervention measure. Reports show that the RC operation took 128 minutes. No complications (intraoperative) were recorded. The study depicts that the patients lost only about 60 mL of blood during the procedure. Besides, there were no readmissions after the partakers were discharged from the hospital. As such, Milone et al. (2019) conclude that RC is a very effective and safe procedure for cholecystitis management.

Similarly, Angelou et al. (2018) critically assessed the success of RC procedures from previous studies. The scholars assessed a study with a selected sample size of 44 patients who had undergone RC. Reports showed that 23 participants had gone through ICG-based intraoperative fluorescent imaging, while the other 21 undertook ICG-less SSRC. From a postoperative complication angle, the results showed insignificant differences between the groups. The only significant subtle issue was abdominal pain experienced by two patients that underwent the ICG-incorporated procedure. In yet another study, Angelou et al. (2018) analyzed the clinical outcomes of 179 individuals that partook in the research. Markedly, all participants underwent RC to treat various cholecystitis-related anomalies. Upon analysis, it emerged that six patients had surgical-related glitches. One had a bile leak that led to readmission for percutaneous drainage and endoscopic sphincterotomy. Two others had abdominal pain, while the fourth, fifth, and sixth individuals had a cyst infection, standard bile duct stones increment, and urinary retention, respectively. As such, Ayloo and Choudhury (2014) established that RC could be associated with iatrogenic bile duct injuries. However, Angelou et al. (2018) posited that the conclusion could not inform the medical fraternity's decisions attributable to the small

sample size utilized in the study. Besides, some of the patients were suffering from a preoperative pancreatic pseudocyst. This condition must have contributed to the complications.

2.5 Factors Impacting Patient's Decision Making

Research studies indicate that patients often analyze factors such as the risks, pain severity, postoperative scarring, cost, and their physician's recommendations before choosing their preferred cholecystectomy (Lois et al., 2022). Lee et al. (2017) observed that in their research works involving 120 patients that had to undergo either RC or LC, the decision-making process was based on factors such as hospital stay duration, surgical pain, probable postoperative complications, and recuperation rate. The scholars further issued questionnaires to determine the patients' satisfaction level with each approach (RC or LC). Markedly, the participants preferred RC, citing that its preoperative surgical processes were consistent and easy to follow. Besides, RC was favored due to its minimal scarring and manageable pain. Analytically, one can argue that the patient's decision regarding the most suitable cholecystectomy majorly arises from an angle of life quality impairment factors. Human beings desire to have fulfilling lifestyles with lesser complications. As such, they always choose treatment options that enhance their overall outcome. Any procedure likely to result in postoperative discomfort, increase readmission chances, or lengthen hospital stay duration, will be avoided. This explains why patients choose RC over LC (Lee et al., 2017).

3. METHODOLOGY

3.1 Research Questions and Hypothesis

This study's H1 (first hypothesis) is that "RC is more practical in cholecystitis management than LC." The H2 (second hypothesis) is that "the surgical procedure adopted and its possible clinical outcomes affects cholecystitis patients' attitude towards the treatment of their ailments" Additionally, the H3 (third hypothesis) is that patients' cholecystectomy preference depends on factors such as pain level, cost, recuperation rate, and hospital stay duration. Based on these hypotheses, the researcher will focus on the following research questions as they also offer guidance in fulfilling the study's objectives:

- What clinical advantages in cholecystitis management does robotic cholecystectomy provide?
- Which factors influence patient decision making regarding the most suitable treatment approach for managing cholecystitis?
- What prognosis can one establish from individuals that underwent RC and LC?

3.2 Research Design

The researchers adopted an explanatory and descriptive research design (RD) as it aids in addressing the study's questions comprehensively. Besides, the approach enables scholars to effectively combine quantitative and qualitative data collection techniques (Huang et al., 2017). The selected RD also answers the "what," "where," "who," and "why" questions. Notably, adopting descriptive and explanatory techniques offer more data that enables the researcher to understand the phenomenon. The study also involved a mixed-method (quantitative and

qualitative) research approach as it provides an all-inclusive picture of the population under study, thus, answering the research questions comprehensively. Notably, the quantitative scheme offers numerical data, easing computation, while the qualitative one offers textual information regarding the subject matter. Deductive and inductive approaches also helped in analyzing data.

3.3 Population and Sample Size

Primarily, the target population for this study was derived from MMHS (Memorial Hermann Hospital System), a Houston-founded non-for-profit organization. Notably, the hospital system was selected due to its extensive medical care delivery units comprising several acute care centers with well-equipped surgical rooms. Research studies indicate that MMHS generally serves nearly 6.9 million people within the "Greater Houston." Most of the individuals have streamlined access to the district healthcare facilities. Analytically, the large number of individuals visiting the facility limits research subjectivity by enhancing generalizability. Besides, selecting participants from the same system increases results uniformity. Notably, hospitals' managerial approach differences may create disparities. The researchers employed probability sampling (PS) based on inclusion criteria that the selected individual must be an MHSS cholecystitis patient (scheduled to undergo RC or LC), a family member nursing the individual, or a healthcare professional attached to the surgical team that will perform cholecystectomy. Scholarly works indicate that integrating PS results in unbiased representative samples (Lee et al., 2017). The target populace comprises 946 participants including 768 patients, 100 family members, and 80 operation unit health practitioners. Scholars incorporated the Yamane formula (n= N/ (1+N (e) 2) (n represents required sample size, N indicates population under study, and e corresponds to permissible error) to arrive at a 292 estimated sample size. However, the researchers managed to gather 350 voluntary participants comprising 100 surgical unit health professionals and 250 cholecystitis patients (and their caretakers). Due to the study's objectivity, the researchers did not split the 350 respondents by themselves. They applied a SRM (simple random sampling) technique. Everyone was given an equal chance of being selected. Nonetheless, considering that the patients' population was higher than the medics', it was predictable that the former would produce more participants than the latter. After the selection, it was wise to separate the groups during data collection since they had different concerns regarding the surgical procedures (LC and RC).

3.4 Data Collection

The study incorporated interviews and surveys as the primary data collection techniques. These techniques enabled the researchers to discover the participant's opinions, acquiring first-hand information. Notably, the scholars distributed questionnaires containing quizzes reflecting the research questions and hypotheses based on a five-point Likert scale to the cholecystitis patients. The approach also increased the analysis quality since the data source could be trusted. Essentially, the scholars better understood the patients under cholecystitis treatment experiences and preferences, thanks to the insights gained from the survey and interview. Observations and

systematic reviews of the existing literature were some of the qualitative approaches employed in collecting data.

4. RESULTS AND DISCUSSION

4.1 Data Analysis Tools

The information collected from the filled questionnaires was tabulated using MS Excel and the statistical software tool. Notably, statistical approaches such as percentages, measures of central tendency (mode and mean), and inferential statistical techniques such as correlation and regression were used to compute the gathered data. Besides, recordings from the interview were documented in Word files.

4.2 Findings

The study participants' demographics are as represented in Tables 1, 2, 3, and 4 below.

Table 1: Participant Health Practitioners Demographics

Gender	Frequency	Percentage %	% Valid	Cumulative %
Female	52	52.2	52.5	52.2
Male	48	47.8	47.5	47.8
Total	100	100	100	100

Table 2: Participant Cholecystitis Patients' Gender

Gender	Frequency	Percentage %	% Valid	Cumulative %
Female	132	52.2	52.5	52.2
Male	118	47.8	47.5	47.8
Total	250	100	100	100

Table 3: Study Participants' Age

Age	Frequency	Cumulative Frequency
41 and above	1	1
36- 40	4	5
30-35	28	33
26-29	31	64
25 and below	36	100
Total	100	

Table 4: Study Participants Education Level

Level	Frequency	Percentage %	Valid %

High school and below	4	1.6	1.6
University/College	162	65	65
Postgraduate	84	33.4	33.4
Total	250	100	100

Furthermore, the scholars encompassed the IOC (item-objective congruence) to measure the similarity and correspondence of the participants' responses quantitatively. It emerged that 33 answers were incongruent, and 45 were congruent among respondents aged between 25 and 41. They further tested for the validity of the results using the inter-item correlation analysis formula on SPSS. The test items were positively and significantly inter-related. Besides, the researchers measured the study's reliability using 25 participants as the sample. Markedly, they achieved a .8 Cronbach's alpha, indicating high acceptable consistency. As such, the scholars proceeded to test the research questions. Tables 5 and 6 below illustrate the participants' responses to each study query.

Table 5: RC or LC Preference Frequency Analysis

Surgical Procedure	Frequency	Percentage %	Valid %
Robotic Cholecystectomy (RC)	30	30	30
Laparoscopic Cholecystectomy (LC)	40	40	40
Both LC and RC	30	30	30
Total	100	100	100

The results in Table 5 above depict that 30% of the participants believed that RC is more advantageous than LC. LC was supported by 40%, while 30% remained undecided, selecting RC and LC.

Table 6: Participants' RC and LC Percentage Preference in Terms of Cost, Bearable Postoperative Complications (BPC), and Operation Duration (OD)

Surgical Procedure	Cheaper %	Bearable Postoperative Complications %	Quick Recovery	Operation Duration %	Less Bleeding
Robotic Cholecystectomy (RC)	36	47	46	49	13
Laparoscopic Cholecystectomy (LC)	47	32	30	35	28
Both LC and RC	17	21	24	16	59
Total	100	100	100	100	100

4.3 Discussion

The findings above depict that the core factors that determine the cholecystitis patients' cholecystectomy choice include the degree of pain, the cost of the procedure, the preoperative complications, and outcomes such as scarring, hospital stay, and recuperation rate, and the operation's duration. Analytically, in support of the study's hypothesis, the results confirmed that most patients associate RC with minor bleeding, bearable postoperative complications, and a quick recovery rate. In essence, most patients were more comfortable undergoing RC than LC. As such, the research objective of identifying RC's clinical advantages was achieved. However, LC was still preferred in terms of cost, suggesting that RC is quite expensive for most individuals seeking cholecystitis management services. Analytically, these findings support Lee et al. (2017) assertions that there is a need to improve robotic systems in ways that may reduce their operational costs.

Furthermore, the results depict that younger patients were glad to embrace RC compared to their older counterparts, who were quite reluctant. Perhaps, the introduction of the robotic system in the 21st century could be attributed to this phenomenon. The study also showed that LC partakers had shorter operation time than those who underwent RC. These results tally with previous scholarly findings, which depicted that RC takes longer timeframes due to various technicalities involved in fixing the robotic system. Besides, surgeons are still acquainting themselves with RC's workability, considering that it is the newest approach for managing cholecystitis. It is worth noting that the cholecystectomy's duration matters substantively since extended periods translate to more anesthesia. The operating time also increases operational costs considering that the extra hours spent attending to one patient could have been used to provide care to others.

It also emerged that the postoperative status of patients in both groups was stable and clinically manageable. The healthcare professionals who participated in the study asserted that RC was more advantageous in aspects such as 3D visualization and freedom of movement (higher range of motion), enhancing successful operation. Essentially, such benefits enable surgeons to carefully remove the gallbladder without obstructing the bile duct and other organs neighboring it (gallbladder). This is an improvement considering that previous studies had increasingly associated LC with such postoperative complications. Analytically, the numerical evidence that the respondents provided helped in comparing the approaches. However, little scholarly work on the subject matter limited the researchers' ability to develop a baseline for comparing their findings. Nevertheless, the reliability and validity tests gave commendable values, which proved that this study is trustworthy and has high dependability. As such, one can argue that the sample population (health professionals, cholecystitis patients, and their families) significantly contributed to this study.

The study findings generally depict that the modern cholecystitis management approaches, especially RC, help substantially reduce the adverse clinical outcomes that patients would previously undergo in the traditional cholecystectomies. Analytically, the increased benefits associated with RC show that the medical fraternity should increasingly adopt it during surgical operations. However, this does not mean that they should altogether ditch LC. Although limited, LC has some benefits that override RC. Considering that the study focuses on RC, one can

indisputably argue that introducing robotic systems in disease management brings more good than harm. Essentially, issues such as high cost and increased operative time have no direct impact on the patient's wellbeing. Arguably, the patient may be willing to pay more or take more prolonged periods in the surgery rooms if they are guaranteed nearly 100% positive outcomes. Therefore, more focus should shift to improving RC to ensure that it comprehensively addresses the cholecystitis patients' problems.

5. CONCLUSION

Analytically, as much as RC has several advantages (lesser bleeding, minimal postoperative complications, and faster recovery rate) over LC, one cannot ignore its shortcomings. Firstly, RC is relatively expensive and requires more operating time. The fact that surgeons take longer to perform the procedure shows that most are still struggling with skills transfer from laparoscopic surgery to robotic-aided operations. As such, the approaches should be used concurrently until the specialist team acquires more knowledge and skills in undertaking RC. This is in light of this study's findings, where a considerable number of patients seemed undecided and therefore opted for both LC and RC. Ideally, the surgeons could focus on the benefits that each procedure offers to improve patient outcomes and overall cholecystitis management.

Undeniably, the growing need for specialists to adopt less intrusive surgical procedures places RC at the center of cholecystitis management. Notably, its single incision technique minimizes invasion while improving clinical outcomes. The study depicts that postoperative complications and higher readmission rates that characterized the traditional cholecystitis management methods have been addressed in RC. Therefore, surgeons should tap into the advantages that RC presents while figuring out ways to reduce its downsides. Arguably, its benefits, such as enhanced visibility and range of motion, are invaluable in surgical operations. Generally, RC has substantively contributed to cholecystitis management. However, there is a need for researchers to examine the approach thoroughly, perhaps based on randomized clinical trials that sufficiently compare RC against LC. It is recommendable to publish more evidence-based research that equates the cholecystectomies as this will ensure more precise distinctions. Moreover, the factors affecting patients' decision making on their preferred cholecystitis management approach majorly depend on personal preferences concerning cost, postoperative scars, and hospital stay. Surgeons should consider these choices and advise their clients on the most appropriate cholecystectomies.

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