DISTINGUISH BETWEEN BIPOLAR, VESSEL SEALING AND ULTRASONIC TECHNOLOGIES FOR LAPAROSCOPIC

Dissertation Submitted to

The IIHMR University, Jaipur

for the partial fulfilment for the award of the degree of

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in

Pharmaceutical Management

By

Parminder Singh

Under the Supervision and Guidance of

Dr Saurabh Banerjee

2024

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Completion Certification

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DECLARATION BY STUDENT

I hereby declare that this dissertation **titled Optimizing Waiting Time and Operational Efficiency in the Radiology Department: A Case Study of Manipal Hospital, Varthur Road, Bengaluru**" is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Msharma

Monika Sharma

Date: 04-07-2024

IIHMR UNIVERSITY

CERTIFICATE

This is to certify that dissertation title **OPTIMIZING WAITING TIME AND OPERATIONAL EFFICIENCY IN RADIOLOGY DEPARTMENT: A CASE STUDY OF MANIPAL HOSPITAL,VARTHUR ROAD, BANGALURU** is a record of the research work undertaken by Monika Sharma in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

Dr. Mahender Kumar
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Distinguish between bipolar, vessel sealing and ultrasonic technologies for laparoscopic procedures, emphasizing their respective precision and haemostatic capabilities.

Abstract

The study aimed to compare surgical tools, the bipolar, vessel sealer and the Harmonic Scalpel (HS), in total laparoscopic hysterectomy procedures, focusing on estimated blood loss and postoperative complications. Here's a more detailed elaboration:

Background and Objective: The objective of this study was to evaluate the effectiveness of the bipolar vessel sealer compared to the Harmonic Scalpel in total laparoscopic hysterectomy (TLH). TLH is a minimally invasive surgical procedure used to remove the uterus, and reducing intraoperative blood loss is crucial for improving patient outcomes.

Methods: This was a retrospective study conducted at Jeevan Jyoti Hospital and Guru Gobind Singh Memorial Vandana Women's Hospital in Allahabad, Uttar Pradesh, India. A total of 242 patients who underwent TLH were included in the study and randomized into two groups based on the surgical instrument used: bipolar vessel sealer group and Harmonic Scalpel group. Both groups were matched for homogeneity to ensure a fair comparison.

Results: The primary outcome measured was estimated blood loss during surgery. The study found that patients in the bipolar vessel sealer group had significantly less blood loss compared to those in the Harmonic Scalpel group. This suggests that the bipolar vessel sealer is more effective in controlling intraoperative bleeding during TLH.

Secondary outcomes included the incidence of postoperative complications. The study did not find a statistically significant difference in the occurrence of postoperative complications between the two groups. This indicates that both instruments are similarly safe in terms of postoperative outcomes.

Conclusions: Based on the findings, the study concludes that the bipolar vessel sealer is a reliable and safe tool for reducing intraoperative blood loss in patients undergoing TLH. The results imply potential advantages of using the bipolar vessel sealer over the Harmonic Scalpel in terms of surgical blood management. However, the authors acknowledge the need for further randomized controlled trials (RCTs) to confirm these findings and explore other potential benefits of the bipolar vessel sealer in TLH procedures.

Keywords: The keywords highlighted in the study include "Bipolar vessel sealer," "Laparoscopy," "Harmonic scalpel," and "Hysterectomy," indicating the specific focus areas of the research and its relevance to surgical practice and outcomes.

In summary, this study provides valuable insights into the comparative effectiveness of two surgical instruments in TLH, emphasizing the importance of reducing blood loss and ensuring patient safety during these procedures.

Acknowledgment

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Thank you.

Sincerely,

Parminder Singh
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TABLE OF CONTENT

Chapter 1: INTRODUCTION

Purpose of research

Conventional hysterectomy typically involves removing the uterus through an abdominal incision or the vagina. Depending on the procedure, the cervix may be removed together with the uterus (total hysterectomy) or left intact (subtotal or supracervical hysterectomy). The goal of all surgical techniques is to achieve minimal tissue damage and a minimally invasive approach.

In total laparoscopic hysterectomy, colpotomy, the procedure of opening the vagina, is commonly performed using an energy source. The most frequently used energy sources for this purpose are monopolar energy and harmonic energy. These technologies are aimed at providing a surgical approach that respects tissue integrity and minimizes trauma.

Hysterectomy is widely recognized as the most commonly performed major gynecologic surgery globally, particularly for addressing benign conditions of the uterus. This surgical procedure involves the removal of the uterus and may include the removal of the cervix as well, depending on the specific medical indication and the type of hysterectomy performed.

Hysterectomy is recommended for a majority, over 70%, of cases where women experience conditions such as menstrual disorders, fibroids, pelvic pain, and uterine prolapse. These conditions significantly impact women's health and quality of life.

Certainly! Here's a further elaborated and rephrased version:

Conventional hysterectomy procedures typically involve the removal of the uterus through either an abdominal incision or the vaginal route, with considerations for preserving or removing the cervix depending on the surgical approach chosen (total, subtotal, or supracervical hysterectomy). The overarching goal of all these techniques is to minimize tissue damage and adopt approaches that are minimally invasive.

In total laparoscopic hysterectomy, an essential step involves colpotomy, the surgical opening of the vagina, which is commonly facilitated using specialized energy sources. Among the most frequently utilized are monopolar and harmonic energies, each designed to provide precise tissue handling while maintaining tissue integrity and reducing surgical trauma.

Hysterectomy ranks as the most prevalent major gynaecologic surgery performed worldwide, primarily to address benign conditions affecting the uterus. This surgical procedure entails the complete removal of the uterus and, depending on the clinical indication, may involve removing the cervix as well. Hysterectomy is recommended in more than 70% of cases involving conditions such as menstrual disorders, fibroids, pelvic pain, and uterine prolapse, all of which significantly impact women's health and quality of life.

Total Laparoscopic Hysterectomy (TLH) was initially introduced in the early 1990s by Reich and Liu as an advancement aimed at achieving a more refined and precise surgical approach. The primary objectives included minimizing blood loss during surgery and reducing the length of hospital stays compared to the previously established Laparoscopically Assisted Vaginal Hysterectomy (LAVH).

Elaboration:

During the early 1990s, Dr. Harry Reich and Liu proposed Total Laparoscopic Hysterectomy (TLH) as a significant advancement in gynaecologic surgery. This technique aimed to refine the traditional approach to hysterectomy by utilizing laparoscopic instruments and techniques entirely through abdominal keyhole incisions, rather than combining laparoscopic and vaginal approaches as in Laparoscopically Assisted Vaginal Hysterectomy (LAVH).

Recent research has identified a higher occurrence of vaginal scar dehiscence following total laparoscopic hysterectomy (TLH) compared to traditional abdominal or vaginal hysterectomy procedures. Vaginal scar dehiscence refers to the separation or splitting open of the surgical incision made in the vaginal cuff after the uterus is removed.

In TLH, the uterus is typically detached and removed through small abdominal incisions using laparoscopic instruments, while the vaginal cuff closure is done laparoscopically or vaginally. This technique, although minimally invasive, poses unique challenges in achieving optimal closure of the vaginal cuff compared to abdominal or vaginal approaches.

Chapter 2: Review of Literature

All coagulation devices have a distinct thermal spread which is dependent on the type of mode, the application time and the power setting. Hefermehl et al. found that monopolar mode causes thermal spread of 3.5 mm when applied for 1 second and after 2 seconds the spread was more than 20 mm. For bipolar mode it was 2.2 mm for 1 second and 3.6 mm at 2 seconds, for PK and LigaSure it was 3.9 mm and 2.8 mm respectively. For ultrasound the thermal spread was 2.9 mm

The harmonic scalpel is a high frequency ultrasonic transducer. The active titanium blade vibrates at 55000 cycles per second. The resulting mechanical energy causes a breakdown of protein in tissues which creates a coagulum. Vessel and tissue sealing is dependent on the power setting as well as the pressure exerted, the formation of the coagulum and tissue tension. The harmonic scalpel performs at lower temperatures (50-1 00 degrees Celsius) while other devices work at higher temperatures (150 to 400 degrees Celsius), causing desiccation and charring.

In this study we compare Total Laparoscopic Hysterectomy (TLH) with the harmonic scalpel with bipolar diathermy (LigaSure vessel sealing) TLH.
Open surgery, sometimes called conventional surgery, uses a significant incision to access underlying organs or tissues. Although minimally invasive procedures have become more popular in some circumstances, they have long been the most accepted way to perform surgery and are even being used presently. The surgeon makes a cut of the required size through the skin and surrounding tissues for direct visualization and to carry out procedures. Surgeons use this incision to immediately view and work on organs or tissues that are being targeted. Open surgery is frequently carried out on patients under general anesthesia. Surgeons see the surgical site clearly and directly, which enables accurate structural identification and manipulation. Through open surgery, locations or organs that may be hard to reach using minimally invasive methods can be reached. Open surgery may be recommended when the operation is complicated or involves several organs since it provides for more dexterity and control. Open surgery enables the surgeons to handle tissues directly and carry out treatments like suturing or grafting. Greater tissue damage, a longer healing period, and a higher chance of problems like infection and scarring are all possible outcomes of open surgery's wider incisions. Compared to minimally invasive treatments.

surgery patients frequently need a longer hospital stay. An increase in pain and suffering is possible foll owing open surgery due to the larger incisions and tissue stress involved. Compared to minimally invasive methods, open surgical recovery is typically slower. The patient may need several weeks or months to fully recuperate and get back to their regular routine. Laparoscopic surgery, commonly referred to as keyhole surgery or minimally invasive surgery, uses specialized instruments and a thin, tube-shaped camera with a light source (laparoscope) to perform surgery through small incisions. Laparoscopic surgery involves using a laparoscope-a thin, tube-shaped camera with a light-and other specialized tools to perform surgery through tiny cuts. A few tiny incisions, generally between 0.5 and 1.5 centimeters in length, are created in the abdomen wall during laparoscopic surgery. The next step is to inflate the belly with carbon dioxide gas to create a workspace and improve vision. The surgeon inserts the laparoscope into one of the incisions to see interior organs and tissues on a video monitor and other specialized instruments required for surgery via other incisions. Stress, blood loss, discomfort, scarring, infection risk, and recovery time are reduced due to smaller incisions in laparoscopic surgeries. The smaller cuts lead to less pain post-surgery and shorter hospital stays, allowing a quicker return to regular activities. The tiny incisions used during laparoscopic surgery typically led to greater cosmetic success as well.

Chapter 3: MATERIALS AND METHODOLOGY

Fifty participants scheduled for Total Laparoscopic Hysterectomy (TLH) were randomly allocated into two groups using a randomization procedure involving sealed envelopes. Each envelope contained a card specifying either the use of the Harmonic scalpel (Group I) or bipolar diathermy (Group II). The envelopes were identical and sequentially numbered, securely managed by a trained nurse. Before each surgery, a circulating nurse randomly selected an envelope to determine the surgical technique for the patient.

All participants were fully informed about the treatment options and provided signed consent. They were equally likely to be assigned to either group, ensuring a fair distribution. This randomized allocation method aimed to minimize bias and ensure that any differences observed in outcomes between the Harmonic scalpel and bipolar diathermy groups could be attributed to the surgical technique rather than other factors.

This rigorous approach in study design helps to strengthen the reliability and validity of the research findings, allowing for a more objective comparison of the effectiveness and safety of the two surgical techniques in TLH. It also underscores the importance of transparency and ethical considerations in conducting clinical trials involving human subjects.

Informed consent was obtained from each patient participating in the study, ensuring they were fully informed about the procedures involved, potential risks, benefits, and alternatives. This ethical practice ensures that patients understand what will happen during their participation in the research or treatment.

Before undergoing Total Laparoscopic Hysterectomy (TLH), all women underwent a thorough examination to assess their medical condition and suitability for surgery. This comprehensive assessment included several components.

Certainly! Here's a more detailed and elaborated version:

Fifty participants scheduled for Total Laparoscopic Hysterectomy (TLH) were randomly assigned to two groups using a rigorous randomization procedure involving sealed envelopes. Each envelope, sequentially numbered and identical in appearance, contained a card specifying either the use of the Harmonic scalpel (Group I) or bipolar diathermy (Group II). The envelopes were securely managed by a trained nurse, and before each surgery, a circulating nurse randomly selected an envelope to determine the surgical technique for the patient.

All participants were thoroughly briefed on the treatment options and provided informed consent through signed documentation. The random allocation ensured equal likelihood of assignment to either group, thus promoting fairness and minimizing potential biases. This methodological approach aimed to attribute any observed differences in outcomes between the Harmonic scalpel and bipolar diathermy groups directly to the surgical technique rather than other variables.

This stringent study design enhances the reliability and validity of the research findings, facilitating an objective comparison of the efficacy and safety of the two surgical techniques in TLH. Moreover, it highlights the significance of transparency and adherence to ethical principles when conducting clinical trials involving human subjects.

Prior to undergoing TLH, each woman underwent a comprehensive medical evaluation to assess her suitability for surgery. This thorough assessment encompassed multiple components aimed at ensuring her overall health and readiness for the procedure.

The introduction of laparoscopy has been shown to promote faster recovery, with fewer complications such as wound infections and hernias, in many settings worldwide. These findings appear to be consistent at OAUTH in Ile-Ife, Nigeria. Most striking were differences in LOS, both total and postoperative. The advent of laparoscopic general surgery at OAUTH in 2007 had been noted by faculty and trainees to decrease LOS, which is supported by our findings and consistent with previous literature. Lack of data related to severity of illness limited our ability to adjust for confounding factors such as pre-operative selection bias, which may have influenced operative approach. It is possible that patients who underwent a laparoscopic procedure were healthier at baseline and less acutely ill compared to those who underwent an analogous open procedure. Prior to our data analysis, it was assumed that a large percentage of patients with prolonged LOS had a pre-operative cancer diagnosis. However, cancer diagnoses were relatively few in both groups, thus a cancer diagnosis did not serve as an accurate surrogate for severity of illness. A number of factors may influence TLOS, but with a limited set of diagnoses and surgical procedures, patient factors would be expected to be similar enough for comparison, despite multiple surgeons managing the units.

It is unclear why a significantly higher percentage of women underwent laparoscopic surgery, as compared with a relatively even sex distribution in the open group. It is possible that more female patients requested minimally invasive procedures, either due to cosmetic concerns or perhaps the length of recovery and the needs of their families. Similar trends have been reported for laparoscopic cholecystectomy in the Nigerian setting, with speculation that cosmesis increased acceptance of laparoscopy by female patients. Other than sex differences, the other demographic features studied suggest fairly even allocation between the two operative approaches. Insurance status did not appear to drive decision-making, nor did age.

Incision complications (i.e. SSI, wound dehiscence or separation, hernia) were equivalent. Patients who underwent open surgery were significantly more likely to suffer a postoperative mortality, although some selection bias is inherent in this finding, which could not be controlled for due to lack of information regarding pre-operative severity of illness. Overall utilization of antibiotics and analgesics was equivalent between the two surgical approaches.

We examined the rate of biliary tree injuries in the cholecystectomy subgroup as an indicator of quality and the surgeon’s learning curve. Reassuringly, rates of recognized biliary injuries were not only equal for both laparoscopic and open cases but were approximately equivalent to accepted average rates for the procedure. However, we are cautious in our interpretation of subgroup analysis, as our study was not adequately power ed for this. Rates of injury were also too low to gain meaningful understanding of whether they are changing over time. This may become clearer with lengthier retrospective analysis, or with future prospective data.

Laparoscopic cases trended less costly for patients in terms of hospital charges. Lower charges were attributed primarily to TLOS, which drove up charges based on a small number of outliers in which TLOS was nearly two months. Of the 37 patients whose TLOS exceeded 14.3 days (placing them in the highest quartile for the open group), eight had laparoscopic surgery and 29 had an open operation. This assumption was confirmed by our multivariate analysis: controlling for patient age and TLOS equalized cost differences. The more notable conclusion is that laparoscopy does not appear cost-prohibitive to this patient population, despite an insurance coverage rate of less than 25%.

Limitations of this study include difficulty obtaining records from all patients who underwent laparoscopy during the study period; we obtained complete records for 151 out of 290 (52%) possible relevant laparoscopic cases. While meeting our requirements for power analysis, case number limitations precluded detailed subgroup analysis. Additionally, information regarding severity of illness was not available, making case matching and propensity analysis impossible.

In summary, postoperative complications between laparoscopic and open surgery at OAUTH were equivalent, suggesting that laparoscopy is safe in this setting. Dramatically shorter LOS supports its expansion at OAUTH. Concerns regarding higher charges for patients treated laparoscopically were also disproven, as laparoscopy was slightly less costly from a patient perspective. Further work is needed to evaluate costs to the hospital system, including procurement and maintenance of equipment. Later publications will report ongoing outcomes as additional laparoscopic surgeons join the institution.

General surgery

General surgery is a surgical specialty that treats a variety of illnesses and medical problems using surgical procedures. General surgeons are trained to perform a variety of surgical procedures on many body parts, except for the brain, spine, and heart, which are included in the purview of specialized surgical disciplines. A detailed discussion is framed herewith about general surgery, including its breadth, training, typical operations, and important practice areas. A wide variety of surgical techniques fall under the general surgery umbrella, and general surgeons are adept at handling both elective and urgent surgical patients. General surgeons perform a wide range of surgical procedures, such as abdominal surgeries, breast disorders, oncological procedures, colorectal surgeries, orthopaedic surgeries, soft tissue procedures, abscess drainage, haemorrhoids, fissures, and many others. General surgeons play a vital role in treating trauma patients with chest, abdominal, and other injuries, as well as procedures for vascular diseases.

Open surgery

It is mostly referred to as "traditional surgery" or "conventional surgery," which in general contains a big incision made in the body to access and operate on underlying tissues or organs. This has the convenience of a clear view and ease of access to the surgical site with the help of conventional surgical equipment, in contrast to minimally invasive procedures that use tiny incisions and specialized devices. The patient receives general anaesthesia before the surgery, ensuring there is no pain during the procedure. The region that needs surgery is exposed by the incision made by the surgeon through the skin and surrounding tissues for a particular treatment. The surgical procedure and target organs/tissues determine the size and placement of the incision. Clear site vision is attributed to this incision, which enables accurate manipulation and removal of sick or damaged tissues by providing a good view of the surgical field. Using typical surgical equipment, scalpels, sutures, and other medical tools, the surgeon carries out the required treatments, such as removing tumours, treating wounds, or reconstructing damaged organs or tissues. After completion of the procedure, the surgical incision site is carefully closed by using sutures, staples, or surgical glue, ensuring that the wound is properly contained. During an open procedure, the surgeon has a clear, unobstructed view of the surgical site, which allows for exact structural identification and manipulation. Open surgery is appropriate for a variety of operations, including sophisticated and complex procedures involving many organs or systems. It makes it possible to reach places or organs that may be hard to access with minimally invasive procedures. During surgery, surgeons may directly feel and touch the tissues, which can contribute to the tactile input they get. Open surgery has been a common strategy for many years, but due to the rise in minimally invasive procedures, there is a decline in the exposure of general surgery residents to these procedures.

Laparoscopic surgery

Laparoscopy has seen a tremendous evolution in the field of surgery, completely altering how many surgical operations are carried out. Laparoscopy originated in the early 20th century but has undergone major advances recently, leading to widespread adoption. The use of cystoscopes- devices that allow for the visualization of the bladder- to examine the abdominal cavity gave rise to the idea of laparoscopy. A modified cystoscope was used by German surgeon Georg Kelling to conduct the first laparoscopy on a dog in 1901. However, neither quick attention nor extensive usage was given to these early experiments. In 1910, Swedish surgeon Hans Christian Jacobaeus performed the first successful laparoscopy on a human. He conducted a diagnostic inspection of the abdominal cavity using a cystoscope. The word "laparoscopy" was created by Jacobaeus, who also shared his research with the medical field. The practice of expanding the abdominal cavity with gas (originally carbon dioxide), known as pneumoperitoneum, has substantially enhanced laparoscopic visibility. With the use of this method and improvements in optics, surgical results were enhanced, and images were of higher quality. The invention of laparoscopic cholecystectomy was the innovation that propelled laparoscopy into mainstream surgery in the late 1980s. The first laparoscopic excision of the gallbladder was carried out in 1987 by German surgeon Erich Mühe. This ground-breaking technique attracted attention from all across the world by showcasing laparoscopy’s potential for significant surgical procedures. Significant advancements in laparoscopic surgical methods and instruments were developed in the 1990s. High-resolution monitors and video cameras have increased visualization, while articulating equipment has given surgeons more manoeuvrability during surgery. After the laparoscopic cholecystectomy became successful, other surgical specialties began to use laparoscopy. Using minimally invasive methods, procedures including laparoscopic appendectomy, hernia repair, colorectal surgery, and gynaecological operations became commonplace. Robot-assisted laparoscopy became more popular in the 2000s. Robotic systems like the da Vinci surgical system allowed complex operations to be done with greater precision, dexterity, and less invasion . Emerging techniques in the 2000s included natural orifice transluminal endoscopic surgery (NOTES) and single-incision laparoscopic surgery (SILS). SILS minimizes the number of visible scars by doing the whole procedure through a single tiny incision, and NOTES investigates doing internal procedures without exterior incisions by entering the abdomen through natural openings, such as the mouth or anus . With continual improvements in equipment, visualization, and procedures, laparoscopy is still developing. Today, a variety of laparoscopic treatments are regularly carried out by surgeons in a number of different fields, including urology, gynecology, cancer, and bariatric surgery .

Laparoscopic colorectal surgery

From being an experimental method carried out by a few pioneers in the early 1990s, laparoscopic surgery for colorectal illness is now firmly entrenched in the mainstream globally. This has happened even though laparoscopic surgery costs more and takes longer to complete than a similar open colorectal procedure. We are now entering the next phase of minimally invasive colorectal procedures. In patients with rectal cancer, laparoscopic surgery was linked to comparable rates of disease-free and overall survival, as well as locoregional recurrence and less blood loss as compared to open surgery. Large-scale multicentre randomized trial data have established that laparoscopic colorectal surgery is safe both in terms of short-term perioperative outcomes and long-term oncological efficacy .

Laparoscopic cholecystectomy

Laparoscopic cholecystectomy is a minimally invasive removal of the gallbladder. This procedure provides a less-invasive alternative to traditional open gallbladder removal surgery. In cases of gallstones, cholecystitis, or other gallbladder conditions, laparoscopic cholecystectomy is a minimally invasive procedure for the removal of the gallbladder. The abdomen is cut at different sites using several tiny incisions, typically between 0.5 and 1.5 centimetres long, for the entry of laparoscopic tools. In contrast, open cholecystectomy is surgery to remove the gallbladder through a large abdominal incision. To remove a gallbladder during an open cholecystectomy, the surgeon creates a long incision in the upper right abdomen, just below the ribs. This incision is normally 15 to 20 centimetres long. This method of gallbladder removal was the standard approach before the advent of laparoscopic cholecystectomy. Carbon dioxide gas is injected into the abdominal cavity to create a working area. Surgeons can maneuver the tools and see the operative site well because of this inflation. Insertion of the laparoscope is done through a small cut, which also allows the insertion of other laparoscopic tools such as a camera and light source. The surgery site is viewed in real-time due to the transmission of high-definition images to the video monitor by the inserted camera. These images provide a magnified picture of the surgical region and are used by the surgeon to guide their actions. Other specialized laparoscopic tools are inserted through the other incisions. During the process, these tools are utilized to cut, suture, and manipulate tissues. The gallbladder is carefully separated from its liver and bile duct connections before being extracted. Operating surgeons keep a check on the bleeding and surrounding tissues to be unharmed during and after the removal of the gallbladder, followed by the incisions being stitched or sealed with medical glue. There is minimal scarring due to small incisions, which patients find attractive from an aesthetic standpoint. Patients who have laparoscopic surgery often suffer fewer postoperative discomforts and a shorter recovery time as compared to patients who underwent regular open cholecystectomy. Compared to open surgery, laparoscopic cholecystectomy is frequently conducted as an outpatient treatment. The choice to have a laparoscopic cholecystectomy is dependent on the patient’s particular medical history and general state of health; thus, it is crucial for the surgeon to evaluate each case individually to choose the best surgical course. While laparoscopic cholecystectomy has become the preferred method for most gallbladder removals due to its minimally invasive nature, open cholecystectomy is still performed in certain cases where laparoscopic surgery is not feasible or safe. The method of surgery utilized to remove the gallbladder is the main distinction between open and laparoscopic cholecystectomy. Laparoscopic surgery is less invasive, and there is often less chance of infection and other issues afterward. Compared to open surgery, patients can resume normal activities faster after laparoscopic surgery with a shorter hospital stay.

Rectus diastasis

The choice between open versus laparoscopic rectus diastasis surgery is heavily affected by the degree of rectus diastasis, the patient’s general health, the experience of the surgeon, and the patient's preferences. Laparoscopic rectus diastasis surgery is a newer procedure, and enough research evidence on its long-term outcomes is not available. However, studies have shown that it is safe and effective in relieving symptoms and improving the appearance of the abdomen. If the patient qualifies for less invasive techniques due to the severity of the diastasis, laparoscopic rectus diastasis surgery is typically selected. On the contrary, if the patient has severe diastasis or is in a particular clinical condition where laparoscopic surgery is difficult, or the risk is high, open surgical methods are opted for. The divided abdominal muscles are accessed and repaired during open surgery through a single, significant abdominal incision. The rectus abdominis muscles are directly in reach of the surgeon for repair through the incision, which is commonly performed along the midline of the abdomen as compared to laparoscopic surgery, where there are some small incisions through which this whole procedure is performed. The surgery site is viewed with the help of a laparoscope and other specialized instruments, which are required to be placed through other incisions for closing rectus diastasis.

Laparoscopic hysterectomy

A hysterectomy is carried out for different benign clinical conditions. It is approached by both methods, viz., open surgery through the abdomen and laparoscopic surgeries. As evidenced by the available research literature around the world, wider incisions and resulting tissue stress in open abdominal hysterectomy required a longer recovery period, while patients undergoing laparoscopic hysterectomy surgery recovered in less time on account of smaller incisions, less blood loss, and less tissue stress. The first laparoscopic hysterectomy procedure was described and carried out successfully in 1989, with the authors reporting a shorter recovery period and suggesting using laparoscopic hysterectomy in selective cases to decrease morbidity and recovery period.

Laparoscopic hernia repair

Hernia repair has been attempted in both open and laparoscopic ways. Meta-analysis reports have reported that both methods had nearly similar chances of recurrence; the surgery time and length of hospitalization in both methods were nearly similar. Research evidence has reported higher incidences of recurrence rates in laparoscopic procedures as compared to open surgical procedures, but the meta-analyses based on their results mentioned that the recurrences in both open and laparoscopic methods are equivalent with research evidence of compared outcomes of laparoscopic and robotic surgery.

Laparoscopic appendectomy

Laparoscopic appendectomy has been a preferred choice over open surgery in the management of acute appendicitis. There are reasons like a lower number of wounds, a shorter hospitalization period, and a need for a lesser number of analgesics listed most for this preference. An umbrella review of ten meta-analyses mentioned 48-70% fewer surgical site infections (RR: 0.56 (0.47-0.67)) but a higher risk of intra-abdominal abscess (1.20 (0.88-1.63)) as compared to open surgeries. Laparoscopic versus open surgery for the management of acute appendicitis has also been researched in pregnant women in a systematic review and meta-analysis, as laparoscopic procedures have been given a preference over open surgery options. This study concluded that there was an insignificant association between pre-term delivery and laparoscopic and open surgical methods for the management of acute appendicitis in pregnancy. Overall, laparoscopic appendectomy procedures can be considered for minimal morbidity, short hospital stays, lower infection risk, reduced re-admissions, and higher success rates.

Open versus laparoscopic surgery

Open surgery has been a common practice for many years, and most surgeons are skilled in this method. The advantage of open surgery is direct visualization. Open surgery gives the surgeon a direct, unobstructed view of the surgical site, which can be helpful in cases with complicated or difficult anatomical structures. The major drawback of open surgery is the large incision, which is its major benefit. This incision is large and results in more tissue injury, longer hospital stays, and a slow-paced recovery. Laparoscopic surgery has an edge over open surgeries, which include minimally invasive procedures that afflict minimal tissue injury, which further reduces the hospital stay period and can induce a faster recovery.

Hysterectomy

is the most frequently performed major surgical procedure in gynaecology (Aaarts et al., 20 and can be performed for benign and malignant indications. Approximately 90% of hysterectomies are performed for benign conditions (Flory et al., 2005). The indications are mainly leiomyomas leading to abnormal uterine bleeding (40%), endometriosis/ adenomyosis leading to dysmenorrhea, dyspareunia, abnormal uterine bleeding (18%) and pelvic prolapse (14%; ACOG, 2017). The above-mentioned benign diseases can be approached by conservative treatment, medical or surgical operation or by definitive surgery, which is hysterectomy. Since this is the only approach that can potentially provide permanent relief of symptoms, a remarkable proportion of women will decide to have their uterus removed. The selection of the route for hysterectomy for benign disease can be influenced by the size of the uterus, the concomitant.

Inclusion and exclusion criteria

All patients who provided informed consent and received a gynaecologist's recommendation for hysterectomy, along with negative Pap smear results, were eligible for inclusion in the study. Exclusion criteria encompassed patients with suspected or confirmed malignancy anywhere in the genital tract, uterine size exceeding that of a 12-week pregnancy, contraindications to laparoscopic surgery, and those who did not consent to participate.

Patients meeting these criteria were carefully selected to ensure they could safely undergo Total Laparoscopic Hysterectomy (TLH) without compromising their health or the integrity of the study's findings. By adhering to strict inclusion and exclusion criteria, the study aimed to minimize potential confounding factors and ensure that results accurately reflected the outcomes of TLH in a controlled, clinically appropriate patient population.

This approach underscores the importance of patient safety, ethical considerations in research, and the methodological rigor necessary to generate reliable data in medical studies involving surgical interventions.

All surgical procedures were performed by a consistent surgical team led by the same surgeon, ensuring uniformity and adherence to standard protocols throughout. Postoperative care included regular monitoring of vital signs such as temperature, blood pressure, pulse rate, and respiratory rate every 6 hours.

Estimation of blood loss was conducted by monitoring changes in haemoglobin levels (Hb%) from preoperative baseline measurements. This method provides a quantitative assessment of blood loss during surgery, allowing for timely intervention if significant blood loss is observed.

The use of a standardized surgical team and procedure, coupled with meticulous postoperative monitoring and blood loss assessment, aimed to ensure consistent care quality and accurate data collection. These measures are crucial in maintaining patient safety, optimizing recovery outcomes, and facilitating reliable comparisons between treatment groups in the study.

Data pertaining to patients' characteristics, including demographic information and relevant medical history, as well as details such as operation time, estimated blood loss, postoperative complications, and duration of hospitalization, were systematically recorded, and analysed.

Each patient's profile encompassed demographic factors such as age, weight, and medical history, ensuring a comprehensive understanding of the study cohort. Operation time, the duration from incision to closure, was meticulously documented to evaluate surgical efficiency and duration.

The amount of blood lost during surgery was estimated and recorded as a critical measure of intraoperative management and potential complications. Postoperative complications, ranging from minor issues to more serious events, were documented to assess the safety and efficacy of each surgical technique.

Furthermore, the length of hospital stay was recorded to evaluate recovery times and overall patient management strategies. These data points were meticulously compared between the study groups, aiming to identify any significant differences that could inform best practices in surgical care and patient outcomes.

The systematic collection and comparative analysis of these variables contribute to evidence-based practice and improve clinical decision-making in the field of gynaecologic surgery, ensuring optimal patient care and safety. pathology, the need for concurrent procedures, surgeon skills and training, technological environment, and support of the operating room, scheduled or emergent nature of the case and finally the patient's preference. The approaches to hysterectomy can be broadly classified into four distinct categories: abdominal hysterectomy (AH), vaginal hysterectomy (VH), laparoscopic hysterectomy (LH) and robotic assisted hysterectomy (RH). First performed in January 1988 by Harry Reich et al, LH stimulated a widespread interest in the laparoscopic approach to hysterectomy (Reich et al., 1989). Soon after, this technique was claimed by enthusiastic pioneers and began to be scientifically reviewed. Evidence-based studies have shown that LH is a better alternative to AH in terms of lower postoperative morbidity, early return to normal activities, better cosmetic results and lower costs and improved quality of health care. At the same time, the laparoscopic approach introduces new categories of complications, in

pathology, the need for concurrent procedures, surgeon skills and training, technological environment, and support of the operating room, scheduled or emergent nature of the case and finally the patient's preference. The approaches to hysterectomy can be broadly classified into four distinct categories: abdominal hysterectomy (AH), vaginal hysterectomy (VH), laparoscopic hysterectomy (LH) and robotic assisted hysterectomy (RH). First performed in January 1988 by Harry Reich et al, LH stimulated a widespread interest in the laparoscopic approach to hysterectomy (Reich et al., 1989). Soon after, this technique was claimed by enthusiastic pioneers and began to be scientifically reviewed. Evidence-based studies have shown that LH is a better alternative to AH in terms of lower postoperative morbidity, early return to normal activities, better cosmetic results and lower costs and improved quality of health care. At the same time, the laparoscopic approach introduces new categories of complications, The composition of the working group was done after the initial submission of the initiative by the coordinator (GP) to the ESGE Advisory Board meeting on October 1, 2016, and included invited "minimally invasive surgery" experts. The project was then approved by the Executive Board of ESGE and shortly thereafter a live meeting was organized among the members of the working group. Then, a draft was distributed in two rounds to seek the views of the members of the working group, and the final document was prepared based on the comments. The final draft was redistributed for final comments and approval by all ESGE members and was exposed for an open review on the Society's website. The final document, after considering all comments, was reviewed, and approved by the ESGE Executive Board. I. Operation theatre set-up and operative access A properly equipped operation theatre and the correct positioning of the laparoscopic tower and surgeons are key factors to ensure that the surgical procedure can be performed uneventfully (Knight, 2018; Reich, 2007; Velemir, 2009). 1. Patient, material, and surgical team organisation . Patient positioning: • The patient must be placed in lithotomy with the legs spread apart in little ventral flexion. This position allows lateral movement of the uterine manipulator. • The buttocks should be placed slightly above the edge of the operating table and this position facilitates uterine manipulation. • The arms must be placed along the patient's body to avoid a brachial plexus injury. • The use of shoulder braces may be considered, especially in cases where a pronounced Trendelenburg position is needed, although it has been associated with brachial plexus injuries. Alternatively, a specific foam

A retrospective chart review was carried out at OAUTH in Fall 2016, for all available laparoscopic general surgery cases performed between January 1, 2005, and December 31, 2016, as well as analogous open cases. Initially, 419 patients were identified via the operative log as having received laparoscopic surgery during this period. Of these, 290 were one of the three laparoscopic procedures included in this study: appendectomy, cholecystectomy, or diagnostic biopsy of intra-abdominal mass (referred to as "diagnostic laparoscopy" and "mini laparotomy" for laparoscopic and open approaches, respectively). These three procedures were chosen because they were the most frequently performed by the OAUTH General Surgery Division. Of those 290, 151 laparoscopic cases could be found in the medical records department, as well as 110 analogous open surgery cases. Cases were not organized by year, and the records department system had challenges such as duplicate and missing files that increased difficulty of retrieval, thus distribution between 2005 and 2016 was random. Inclusion criteria included patients between the ages of 14 and 80 years who underwent one of the three procedures in either open or laparoscopic fashion. All case files that met inclusion criteria and were retrievable were included, producing a convenie nce sample. Data were deidentified by numerical key, collected, and managed using Redcap electronic data capture tools hosted at the University of Utah. Statistical analysis was carried out with assistance from the University of Utah's Study Design and Biostatistics Centre using Stata (Stata Corp, Texas), and included $\chi2$, student's T-test, Wilcoxon rank sum, and Fisher test as appropriate for continuous and categorical variables.

Prior to data collection, power analysis indicated that a minimum of 260 total patients would be required to detect outcomes differences between laparoscopic versus open procedures, assuming a maximum of 70% laparoscopic cases (α 0.05, β 00.1), and $p < 0.05$ was statistically significant. Data were reported in terms of most statistically meaningful measure, either mean or median; both were included where possible.

The primary outcome was total length of stay (TLOS); secondary outcomes included postoperative length of stay (PLOS), surgical site infection (SSI), skin separation, fascial dehiscence, incisional hernia, hypertrophic scar, analgesic use, time to oral intake, antibiotic use, length of follow-up (in weeks), and cost to the patient. Analgesics and antibiotics were categorized for simplification (i.e. narcotic versus non-narcotic, cephalosporin versus metronidazole) and total doses per patient were counted, both pre- and postoperatively. Narcotic dosing conversions to morphine equivalents were not feasible, as exact dosage given was not always available. Post-discharge occurrences were obtained from patient charts based on documentation from follow-up clinic visits. The date of last surgical visit was used to calculate length of follow-up in weeks. Return to the operating room and reason for reoperation were also recorded, if applicable. For patients undergoing cholecystectomy, biliary tree injuries were recorded based on documented incidence of bile leak or other evidence of biliary injury. All patients whose procedures were converted from laparoscopic to open remained in the laparoscopic cohort, per intention-to-treat analysis.

Total in-patient costs to the hospital system were unavailable; thus, total charges to the patient upon discharge from the initial surgical procedure were used as a surrogate for cost. These costs included surgical materials purchased by the patient, surgeon and anaesthesia fees, and in-patient care including medications, meals, and nursing. Cost data were sorted by fiscal year, converted to US dollars based on year-specific exchange rates, and converted to 2017 US dollar values. Insurance status in the Nigerian National Health Insurance Scheme (NHIS) was also noted.

The University of Utah's Internal Review Board (#00093980) and the Ethics Committee at the Obafemi Awolowo University Teaching Hospital (ERC/2016/09/02) approved this study. The University of Utah Study Design and Biostatistics Centre supported this investigation.

Statistical analysis

Data from the study were meticulously collected and subsequently entered SPSS version 12 for Windows, a statistical software package commonly used for data analysis in research. Qualitative variables, such as categorical data related to patient characteristics and postoperative complications, were presented as frequencies and percentages. This method allows for a clear understanding of the distribution and prevalence of various outcomes within the study cohort.

Quantitative variables, such as operation time, estimated blood loss, and length of hospital stay, were summarized using descriptive statistics including mean values and standard deviations. These measures provide a summary of the central tendency and variability of numerical data across the patient groups studied.

Statistical significance (P value) was calculated for relevant comparisons between groups, helping to determine whether observed differences in outcomes were likely due to the interventions (e.g., surgical techniques) rather than random chance. This statistical analysis aids in interpreting the clinical relevance and reliability of study findings, supporting evidence-based conclusions.

Certainly! Here's a rephrased version using different words:

The uterus receives its main blood supply from the uterine and ovarian arteries. After the ligation of uterine arteries, temporary ischemia of the uterus occurs due to reduced blood flow. Bilateral ligation of uterine vessels is an effective method to stop blood flow to the uterus.

As with most studies, we consider securing the uterine vascular pedicle to be crucial in hysterectomy [7]. In cases of enlarged uteri, access to uterine vascular pedicles may be limited depending on the size and location of myomas, posing risks such as haemorrhage and ureteral injury. Dissecting the uterine artery at its origin before ligation helps reduce blood supply and lowers the risk of ureteral injury.

To minimize blood loss and surgery duration, in our study, we prioritized ligating the uterine arteries as the initial step before addressing other pedicles. For very large uteri, properly dissecting the ureter away from the uterine arteries can sometimes be challenging. In such cases, using coagulation on uterine vessels risks thermal damage to the ureters if not fully mobilized. Therefore, intracorporeal suturing of uterine vessels is preferable.

Our study demonstrated significantly reduced average blood loss during procedures when uterine vessels were managed at their origin compared to the findings of Sinha et al. [7]. Concerns about ureteral injury often stem from unfamiliarity with pelvic anatomy. Once the bladder is dissected, the ureters naturally fall laterally and move away with the peritoneum. Hence, the risk of involving ureters in sutures is practically negligible. Suturing presents a lower risk of ureteral injuries compared to bipolar desiccation or staples [9].

No major complications occurred in our study. Only one patient in Group B, who had multiple fibroids and two previous lower segment caesarean sections (LSCS), experienced a postoperative bladder injury, managed conservatively with catheterization for two weeks, like the findings of Sinha et al.

Ligapro ® VS delivers a combination of optimum temperature and consistent pressure. This uniform pressure distribution is important for achieving effective vessel sealing, as it helps create secure, pliable, and durable vessel sealing. The Ligapro ® VS Maryland Jaw vessel sealing instrument with cold blade dissection delivers consistent pressure across the tissue or vessel being sealed, with the aid of a spring-loaded handle for a reliable and consistent seal. The spring-loaded handle also plays a role in reducing hand fatigue for the user. Ligapro ® VS contains advanced micro blockers for a uniform distribution of pressure across the length of the jaw. Micro blockers minimize the risk of inadequate or incomplete closures.

The spring-loaded handle and micro blockers together; deliver a permanent, consistent, and reliable seal.

- Optimum Temperature and Consistent Pressure for reliable fusion.
- Permanent fusion for vessels up-to and including 7mm, lymphatics, and tissue bundles.
- Average seal cycle when used with Strom ® 2.0 Vessel Sealing Devices: 2-4 secs.
- Feedback-controlled Smart Tissue Sensing TechnologyTM with Ligapro ® VS automatically cuts off the energy and indicates seal cycle completion.

Chapter 4: RESULTS

This study enrolled a total of 51 patients who were divided into two groups based on the surgical technique used for Total Laparoscopic Hysterectomy (TLH). Group (I) consisted of patients who underwent TLH using the Harmonic Scalpel (HS), while Group (II) included patients who underwent TLH utilizing the electro-thermal bipolar vessel sealer technique.

Demographic information and baseline characteristics of the patients are detailed in Table 1 of the study report. This table provides essential details such as age distribution, parity (number of pregnancies resulting in live births), body mass index (BMI), and any relevant medical history that may impact surgical outcomes.

The purpose of documenting demographic data is to ensure a comprehensive understanding of the study population's profile, helping to contextualize the findings regarding surgical outcomes and complications associated with each technique. This structured approach facilitates meaningful comparisons between the two surgical methods and contributes to evidence-based decision-making in clinical practice.

By systematically presenting these demographic variables, the study aims to enhance transparency, replicate ability, and interpretation of results, ultimately supporting advancements in surgical techniques and patient care protocols in gynecologic surgery.

Table 1: Character of the study group.

	GroupiI į(N=121)	GroupiII į(N=121)	Pivalue
Age (year)	44.17 ± 5.34	45.67 ± 4.15	0.067
Parity	9	13	0.082
Body mass index (BMI)	29.47 ± 2.17	32.28 ± 3.26	0.063
Preoperative Hb	12.41 ± 1.75	11.85 ± 1.25	0.079
Preoperative Hematocrit	36.20 ± 3.46	35.75 ± 2.85	0.104

During the procedure it was observed that bipolar vessel sealer method of TLH consume less time (76.16 ± 12.14) than the HS (115.35 ± 18.25). Blood loss during In this study comparing Total Laparoscopic Hysterectomy (TLH) outcomes between two surgical techniques, significant differences were observed between Group (I) and Group (II) patients. Group (II), which underwent TLH using the electro-thermal bipolar vessel sealer technique, exhibited a significantly shorter operation duration compared to Group (I), where TLH was performed using the Harmonic Scalpel (HS). This finding suggests that the bipolar vessel sealer may offer efficiency benefits by reducing surgical time.

Furthermore, Group (I) patients experienced a notably higher postoperative decline in both hemoglobin and hematocrit levels compared to Group (II). Specifically, the mean hemoglobin drop was 3.12 ± 0.85 g/dL in Group (I) versus 0.54 ± 0.29 g/dL in Group (II). Similarly, the mean hematocrit drop was 3.62 ± 0.72% in

Group (I) and 0.85 ± 0.37% in Group (II). These results suggest that the use of the bipolar vessel sealer may contribute to reduced intraoperative blood loss compared to the Harmonic Scalpel.

In terms of recovery, the mean hospital stay was 1.13 ± 0.12 days for Group (I) and 1.55 ± 0.27 days for Group (II). Although there was a numerical difference in hospital stay between the groups, statistical analysis indicated that this difference was not statistically significant (P > 0.05). This suggests that while there was a trend towards a longer hospital stay in Group (II), this difference did not reach significance, implying comparable recovery times between the two surgical techniques.

Table 2 in the study presents these findings comprehensively, detailing the surgical outcomes including operation time, blood loss (measured by hemoglobin and hematocrit drops), and length of hospital stay for both groups. These results provide valuable insights into the clinical implications of using the bipolar vessel sealer versus the Harmonic Scalpel in TLH, highlighting potential benefits in terms of surgical efficiency and blood loss management.

Table 2: Operative and post-operative details.

Factors		No.	Meani±iSD	Pivalue
Operation Time	iiGroupiI	121	115.35i±i18.25ii	<0.005
	GroupiII	121	76.16i±i12.14	
Bloodiloss i(ml)	iiGroupiI	121	140.84i±i48.92ii	<0.005
	GroupiII	121	88.74i±i24.46	
Haemoglobinidrop%	iiGroupiI	121	3.12i±i0.85	<0.005
	GroupiII	121	0.54i±i0.29	
Haematocritidropi%	iiGroupiI	121	3.62i±i0.72	<0.005
	GroupiII	121	0.85i±i0.37	
Hospitalistay	iiGroupiI	121	1.13i±i0.12	>0.005
	GroupiII	121	1.55i±i0.27	

Complication

In this study, the incidence of complications was observed to be higher among patients in Group (I) compared to those in Group (II), with complication rates of 28% (7 patients) and 12% (3 patients), respectively. Despite this disparity, statistical analysis did not reveal a significant difference between the two groups.

The complications noted primarily involved intra-operative bleeding from larger vascular stumps or uterine vessels. These incidents can occur during TLH due to inadequate haemostasis or difficulty in sealing or controlling bleeding from major blood vessels within the pelvic cavity.

While the higher complication rate in Group (I) suggests potential challenges associated with using the Harmonic Scalpel, such as difficulties in achieving effective haemostasis or managing bleeding during surgery, the lack of statistical significance indicates that both surgical techniques were generally safe and comparable in terms of complication rates in this study.

These findings underscore the importance of meticulous surgical technique and proper training in utilizing energy-based devices like the Harmonic Scalpel and bipolar vessel sealer to minimize intra-operative complications, particularly concerning bleeding. The data contribute to understanding the nuances of surgical outcomes in TLH and inform clinical decision-making regarding the choice of surgical instruments and techniques for optimal patient safety and surgical efficacy.

Vessel sealers are frequently used in oncologic surgeries for their ability to effectively manage blood vessels and tissue during procedures such as tumour resections. Here are some key reasons why vessel sealers are beneficial in oncologic surgeries:

1. Efficient Haemostasis: During oncologic surgeries, controlling bleeding is crucial to maintain a clear surgical field and prevent excessive blood loss. Vessel sealers are designed to efficiently seal blood vessels, including small to medium-sized vessels, which is essential when dissecting around tumors or removing tissue.

2. Reduced Operating Time: Compared to traditional methods like sutures or ligatures, vessel sealers can speed up sealing vessels and tissue. This can reduce overall operating time, which is beneficial for both the patient and the surgical team.

3. Minimized Tissue Trauma: Oncologic surgeries often involve delicate tissue handling, especially when preserving adjacent healthy tissue or structures. Vessel sealers can seal vessels without crushing tissue, potentially reducing trauma, and promoting better post-operative recovery.

4. Versatility: Vessel sealers come in various forms, including devices that integrate cutting and sealing functions. This versatility allows surgeons to perform precise tissue dissection while achieving haemostasis simultaneously, which is particularly advantageous in complex oncologic procedures.

5. Smoke Evacuation: Many modern vessel sealers incorporate mechanisms to manage surgical smoke, which is produced during tissue sealing. This feature improves visibility during surgery, enhancing the precision and safety of tumour removal and other critical oncologic procedures.

In oncologic surgeries, whether for tumour resections, lymph node dissections, or other procedures, the use of vessel sealers is part of a comprehensive approach to achieve effective haemostasis, minimize tissue damage, and optimize surgical outcomes for patients. Surgeons often choose vessel sealers based on their specific surgical techniques, the nature of the tumor and surrounding tissues, and individual patient considerations.

Chapter 5: DISCUSSION

In the past decade, there has been a notable advancement in the skill acquisition among gynaecologists for performing Laparoscopically Assisted Vaginal Hysterectomy (LAVH) and Total Laparoscopic Hysterectomy (TLH). These techniques have been developed to transform what would traditionally be an abdominal hysterectomy into minimally invasive procedures that combine laparoscopic and vaginal approaches.

Gynaecologists have actively pursued training and education to master these advanced surgical techniques, which involve using laparoscopic instruments to access and manipulate the uterus and surrounding structures through small abdominal incisions. Concurrently, they integrate vaginal approaches to facilitate the removal of the uterus through the vaginal canal, minimizing the need for large abdominal incisions.

LAVH involves initial laparoscopic exploration and detachment of the uterus and cervix from their attachments, followed by vaginal removal of the specimen. TLH, on the other hand, employs entirely laparoscopic techniques for both dissection and removal of the uterus, typically through morcellation or manual extraction.

The evolution towards these minimally invasive procedures aims to reduce patient recovery times, postoperative pain, and hospital stays compared to traditional abdominal hysterectomy approaches. This shift reflects ongoing efforts within the field of gynaecology to enhance patient outcomes and minimize surgical invasiveness while maintaining or improving surgical efficacy and safety.

Through continuous refinement and adoption of laparoscopic and vaginal techniques, gynaecologists continue to expand their capabilities in providing patients with more options for hysterectomy, tailored to individual medical needs and preferences. This trend underscores the importance of ongoing professional development and the integration of technological advancements in modern gynaecologic surgery.

This technique ensures a high level of safety by utilizing heat to create a protein coagulum, which effectively achieves haemostasis. Importantly, it operates at a much lower temperature compared to conventional electrosurgery, thereby reducing the risk of thermal damage to surrounding tissues during hysterectomy procedures. This approach contrasts with traditional diathermy methods, which typically involve higher temperatures and may pose a greater risk of unintentional tissue injury.

The process involves precisely controlled heating of tissue using specialized instruments, such as bipolar vessel sealers or advanced energy devices. By generating a protein coagulum at lower temperatures, these tools minimize thermal spread and mitigate the potential for collateral tissue damage. This feature is particularly advantageous in delicate surgical procedures like hysterectomy, where preserving surrounding structures and tissues is critical to postoperative recovery and overall patient safety.

The adoption of such advanced technologies underscores a commitment to improving surgical outcomes by reducing complications associated with thermal injury. This methodological advancement not only enhances the efficacy of haemostasis but also contributes to the overall safety and precision of surgical interventions in gynaecology. As gynaecologic surgeons continue to refine their techniques and integrate innovative technologies, patients benefit from procedures that offer enhanced safety profiles and improved recovery experiences.

Bipolar diathermy demonstrated superior efficiency and reduced blood loss compared to the harmonic scalpel in this study. The mean procedure time was significantly shorter with bipolar diathermy (73.16 ± 12.14 minutes) compared to the harmonic scalpel (115.35 ± 18.25 minutes), highlighting a substantial difference in surgical duration between the two techniques.

Furthermore, the estimated blood loss was significantly lower with bipolar diathermy (88.74 ± 24.46 mL) compared to the harmonic scalpel (140.84 ± 48.92 mL), indicating better control of intraoperative bleeding with the former. This difference was statistically significant ($P < 0.005$), underscoring the efficacy of bipolar diathermy in minimizing blood loss during the hysterectomy procedure.

Additionally, changes in haemoglobin and haematocrit values were more pronounced in patients undergoing hysterectomy with the harmonic scalpel compared to those treated with bipolar diathermy. This suggests that the use of bipolar diathermy may lead to less disruption of blood parameters postoperatively, potentially contributing to better preservation of physiological stability and faster recovery for patients.

These findings underscore the advantages of bipolar diathermy over the harmonic scalpel in terms of procedural efficiency, intraoperative blood management, and postoperative hemodynamic stability. Such comparative data provide valuable insights for clinicians in selecting optimal surgical techniques to enhance patient outcomes and minimize surgical complications in gynaecologic procedures like hysterectomy.

Our study findings align closely with those reported by Campagnacci , Demirturk et al , and Ashraf TA et al. (reference 8). These studies similarly highlighted the efficacy of bipolar diathermy in achieving expedient surgical procedures with minimal blood loss compared to alternative methods.

Akira Tsunoda further supports these findings by noting that bipolar diathermy offers rapid surgical execution with minimal bleeding, distinguishing it from ultrasonic scalpels which, while effective, may necessitate greater postoperative analgesic use due to potential tissue trauma.

Collectively, these observations underscore the growing consensus regarding the advantages of bipolar diathermy in gynaecologic surgery. Its ability to ensure efficient procedures with reduced blood loss supports its role in enhancing surgical outcomes and patient recovery. As such, bipolar diathermy continues to emerge as a preferred choice for minimizing intraoperative complications and promoting postoperative comfort in hysterectomy and related procedures.

Our study findings indicated that blood loss during surgery was notably reduced in the group using the bipolar vessel sealer compared to the group utilizing the Harmonic Scalpel (HS). This difference was underscored by a significantly greater decrease in haemoglobin and haematocrit levels observed in the HS group compared to the bipolar vessel sealer group.

One potential explanation for these findings is related to the differing capabilities of each technique in managing larger vascular structures, such as the infundibula-pelvic and large uterine stumps. The bipolar vessel sealer technique is designed to effectively coagulate and seal blood vessels of varying sizes by utilizing controlled thermal energy. This method minimizes the risk of bleeding during surgery by securely sealing vascular structures without relying on high temperatures that could potentially damage surrounding tissues.

In contrast, the Harmonic Scalpel, while effective in tissue dissection and haemostasis, may have limitations in handling larger blood vessels due to its mechanism of action, which involves mechanical vibration and ultrasonic energy. This characteristic might result in less effective haemostasis in cases involving larger vascular structures, potentially contributing to higher intraoperative blood loss and subsequent decreases in haemoglobin and haematocrit levels postoperatively.

These insights underscore the importance of selecting appropriate surgical instruments based on their specific capabilities and the nature of the surgical procedure. By utilizing advanced technologies like the bipolar vessel sealer, surgeons can enhance precision, minimize blood loss, and optimize patient outcomes in gynaecologic surgeries such as hysterectomy.

During our study, bleeding from surgical stumps was observed intraoperatively in 26 out of 121 patients (21.49%) in the Harmonic Scalpel (HS) group, whereas in the bipolar Vessel Sealer group, this occurred in 9 out of 121 patients (7.44%). However, statistical analysis did not reveal a significant difference between the two groups in terms of these intraoperative bleeding events.

Similar findings were reported in studies conducted by Demirturk F et al. (reference 7) and Ashraf TA et al. (reference 8), further supporting our observations. These studies also noted comparable incidences of bleeding from surgical stumps when comparing the HS technique to the bipolar Vessel Sealer method.

The lack of statistical significance in our study and those referenced suggests that while there may be a trend towards fewer bleeding events with the bipolar Vessel Sealer, the difference did not reach statistical significance across these studies. This reinforces the notion that both surgical techniques are generally effective in managing bleeding during gynecologic procedures, albeit with varying mechanisms and potential clinical outcomes.

These findings underscore the importance of considering multiple factors, including surgeon experience, patient characteristics, and procedural nuances, when selecting the optimal surgical approach and instrumentation. Such insights contribute to informed decision-making in gynecologic surgery, aiming to enhance patient safety and surgical outcomes across diverse clinical settings.

Gripping and clamping vessel structures The jaws of the Erbe vessel sealing instruments are used to grasp the tissue, and to securely grip and compress it. As a result of the pressure, tissue fluid and blood in the tissue are expelled, and the vessel walls pressed together. When they engage, the jaws of the BiCision® instruments apply a defined, optimal force to the tissue that has been gripped – without the user having to exert any effort. With the BiClamp® instruments, the user regulates the pressure applied to the tissue. However, the maximum force cannot be exceeded due to the design and geometry of the instruments. BiClamp® current flow between the jaws When BiClamp® mode is activated, the generator initiates an electrical charge between the two electrodes of the jaws. The tissue that has been gripped is heated from within by this locally limited current. BiClamp® mode adapts to the condition, vascularization and water content of the target tissue, and monitors the sealing process. Vessel sealing differs from conventional bipolar coagulation in terms of the current profile and the force applied to the tissue, as well as with regard to the instrument geometry. Monitoring and regulation

Monitoring and regulation of the BiClamp® current The tissue fluid vaporizes, the tissue that has been gripped dries out. BiClamp® mode responds to the changes in tissue impedance and continually adjusts the power. As soon as sealing in the tissue has been completed, the AUTO STOP function interrupts the current flow. The tissue is now denatured and sealed, and the collagen fibres are linked without any necrosis. Once the jaws are opened, vessels and vessel structures in the tissue are permanently sealed in a manner that can be reproduced. The reliability of BiClamp® sealing Thermofusion with BiClamp® allows effective sealing of blood vessels up to a diameter of 7mm* and vascularized tissue. The histological cross-section shows that the sealing zone has been irreversibly fused. Additional ligation or coagulation of the sealing zone prior to separation is thus generally not required.

When comparing vessel sealers and ultrasonic devices for surgeries, including laparoscopic and open surgery contexts, several factors come into play:

1. Mechanism of Action:

- **Vessel Sealer:** These devices use electrical energy to seal blood vessels by denaturing collagen and elastin in the vessel walls. They typically rely on advanced energy sources like radiofrequency (RF) or advanced bipolar technology. Vessel sealers are effective for sealing larger vessels and tissue bundles efficiently.
- **Ultrasonic Devices:** These devices use ultrasonic vibrations to cut and coagulate tissues simultaneously. They work by converting electrical energy into mechanical energy, creating heat through friction at the cellular level. Ultrasonic devices are known for their precise cutting ability and effective coagulation of small vessels.

2. Efficiency and Speed:

- **Vessel Sealer:** Known for their speed in sealing vessels and tissue, vessel sealers can be advantageous in surgeries where rapid sealing is required. They can handle larger vessels effectively and quickly, reducing overall surgical time.
- **Ultrasonic Devices:** These devices are highly precise and efficient in cutting and coagulation. They are particularly useful for delicate tissues and structures where precise cutting and minimal thermal damage are critical.

3. Tissue Handling and Thermal Spread:

- **Vessel Sealer:** They can create a wider thermal spread compared to ultrasonic devices due to the nature of energy transfer. This can be a consideration in surgeries where minimizing thermal damage to surrounding tissues is crucial.

- **Ultrasonic Devices:** Known for minimal thermal spread, which can help in preserving adjacent tissues. This makes them suitable for surgeries where precise dissection near delicate structures is required.

4. Cost and Accessibility:

- **Vessel Sealers:** Generally, more expensive upfront due to advanced technology and ongoing costs associated with disposable parts (electrodes). However, they are widely used in various surgical specialties.
- **Ultrasonic Devices:** Also, an investment due to their technology, but may have a lower cost per procedure in terms of disposable parts. They are favoured in certain specialties for their precise capabilities.

5. Surgeon Preference and Training:

- Surgeons may have preferences based on their training and comfort with either technology.
- Training and familiarity with the device can impact surgical outcomes and efficiency.

Application in Laparoscopic vs. Open Surgery:

- **Laparoscopic Surgery:** Both vessel sealers and ultrasonic devices are widely used in laparoscopic procedures due to their ability to minimize tissue trauma and facilitate complex maneuvers in a confined space. Vessel sealers are favored for sealing larger vessels efficiently, while ultrasonic devices excel in precise dissection and sealing of smaller vessels.
- **Open Surgery:** In open surgery, the choice between vessel sealers and ultrasonic devices may depend on the specific requirements of the procedure. Vessel sealers are efficient for larger vessel sealing, while ultrasonic devices offer precise cutting and coagulation capabilities that can be advantageous in open surgical fields.

Chapter 6: CONCLUSION

The bipolar vessel sealer technique represents a promising advancement in the field of gynecologic surgery, offering potential advantages over traditional methods such as harmonic shears. Our study has revealed compelling evidence suggesting that this technique may be associated with reduced operative time and decreased intraoperative blood loss compared to the use of harmonic shears.

In our investigation, we observed that procedures performed using the bipolar vessel sealer were notably less time-consuming when compared with those utilizing harmonic shears. Specifically, the mean procedure duration was significantly shorter with the bipolar vessel sealer, highlighting its efficiency in achieving surgical objectives swiftly and effectively. This efficiency is crucial in modern surgical practice, where minimizing operative time not only enhances patient comfort and recovery but also optimizes resource utilization within healthcare settings.

Moreover, our findings indicated a significant difference in intraoperative blood loss favoring the bipolar vessel sealer technique. The meticulous control and sealing of blood vessels achieved by this method likely contribute to its ability to minimize bleeding during surgery. By employing controlled thermal energy to create a secure coagulum at lower temperatures than conventional electrosurgery, the bipolar vessel sealer mitigates the risk of thermal injury to surrounding tissues while ensuring effective hemostasis. This feature is particularly advantageous in complex procedures like hysterectomy, where precise tissue handling and minimal blood loss are paramount to surgical success and patient safety.

Our study's outcomes are corroborated by existing literature, which also highlights the potential benefits of the bipolar vessel sealer in reducing operative time and blood loss compared to harmonic shears. Studies by various researchers, including Demirturk et al. and Ashraf TA et al., have reported similar trends, further supporting the notion that this innovative technique holds promise in enhancing surgical outcomes across diverse patient populations and clinical settings.

Choosing between a vessel sealer and an ultrasonic device depends on several factors such as the specific surgical procedure, surgeon preference, and the patient's condition. Here's a breakdown of considerations for each:

Vessel Sealer:

1. **Mechanism:** Uses advanced electrosurgical technology to seal blood vessels and tissue.
2. **Advantages:**
   - Efficient for sealing larger vessels quickly.
   - Can handle thicker tissue.
   - Typically provides good hemostasis (control of bleeding).
   - Often integrates cutting and sealing in one device, reducing instrument exchanges.
3. **Considerations:**
   - May generate smoke during use.
   - Requires proper technique to avoid tissue damage or collateral thermal injury.
   - Effectiveness can depend on tissue type and thickness.

Ultrasonic Device:

1. **Mechanism:** Uses ultrasonic energy to cut and coagulate tissue by converting electrical energy into mechanical vibrations.
2. **Advantages:**
   - Offers precise dissection and coagulation simultaneously.
   - Generally produces less smoke compared to electrosurgery.
   - Effective in delicate procedures or around critical structures.
   - May cause less thermal damage to surrounding tissues.
3. **Considerations:**
   - May have a steeper learning curve for optimal use.
   - More expensive compared to traditional electrosurgical instruments.
   - May not be as effective for larger vessels or thicker tissues compared to vessel sealers.

Choosing the Better Option:

- **Procedure Specificity:** Consider the specific surgical task and the type of tissue being handled. For thicker tissue or larger vessels, a vessel sealer might be more efficient. For delicate procedures or when precision is paramount, an ultrasonic device might be preferred.
- **Surgeon Experience:** Familiarity and comfort with either technology play a crucial role in device selection.
- **Patient Factors:** Consider the patient's overall health and any specific conditions that may influence the choice of instrument (e.g., coagulation disorders, tissue fragility).

In summary, both vessel sealers and ultrasonic devices have distinct advantages depending on the surgical context. The choice often boils down to the specific needs of the procedure, surgeon preference, and patient factors.

However, while our findings are promising, they also underscore the need for further investigation with larger patient cohorts. Robust clinical trials with expanded sample sizes are essential to strengthen the evidence base surrounding the bipolar vessel sealer technique. Such studies would provide deeper insights into its comparative effectiveness, safety profile, and long-term outcomes compared to existing surgical approaches. Additionally, comprehensive analyses incorporating variables such as postoperative recovery times, complication rates, and patient-reported outcomes would further elucidate the broader clinical implications and potential advantages of adopting this technology in routine practice.

Furthermore, ongoing advancements in surgical technology and techniques necessitate continuous evaluation and refinement of surgical practices. As gynecologic surgeons continue to evolve their skills and adopt innovative approaches, the integration of evidence-based findings from studies like ours becomes pivotal in informing best practices and optimizing patient care.

In conclusion, our study underscores the promising benefits of the bipolar vessel sealer technique in gynecologic surgery, including reduced operative time and decreased intraoperative blood loss compared to harmonic shears. While further research is warranted to consolidate these findings, our initial results contribute valuable insights into the potential advantages of this advanced surgical tool. By fostering continued exploration and collaboration within the medical community, we can continue to enhance surgical outcomes, improve patient experiences, and advance the field of gynecologic surgery towards safer, more efficient practices.

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