SURGEONS' AWARENESS LEVELS AND KNOWLEDGE LEVELS OF VESSEL AND COMPARATIVE ANALYSIS WITH TRADITIONAL TECHNIQUES

Dissertation Submitted to

The IIHMR University, Jaipur

for the partial fulfilment for the award of the degree of

Master of Business Administration (MBA)

in

Pharmaceutical Management

By

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Under the Supervision and Guidance of

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Appendix E: Completion Certification

CERTIFICATE

This is to certify that **SWAPNAJA GANESH GAURKAR** in partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management)/MBA (Pharmaceutical Management)/MBA (Development Management) from the IIHMR University, Jaipur has successfully completed her internship at **WINGLOBE HEALTHCARE PVT LTD** during **March 20 - June 20, 2024.**

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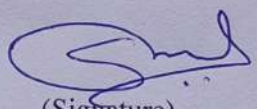
DECLARATION BY STUDENT

I hereby declare that this dissertation titled 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 Information derived from the published or unpublished work of others has been duly acknowledged in the text.



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CERTIFICATE

This is to certify that dissertation title **SURGEONS' AWARENESS AND KNOWLEDGE LEVELS OF VESSEL SEALERS AND COMPARATIVE ANALYSIS WITH TRADITIONAL TECHNIQUES.**is a record of the research work undertaken by Swapnaja Gaurkar in partial fulfillment of the requirements for the award of the degree of MBA Pharmaceutical Management from the IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.

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Abstract

The study explores the awareness levels and knowledge levels of surgeons regarding vessel sealing technology and conducts a comparative analysis with traditional surgical techniques such as the use of bipolar and monopolar instruments. Vessel sealing technology, which utilizes advanced electrothermal mechanisms to seal blood vessels, has become integral in modern surgery due to its efficiency and reduced recovery times. However, the adoption of this technology varies significantly among surgeons, influenced by their knowledge and awareness levels. This study contains a survey conducted and performed in Nagpur district of the state of Maharashtra which aims at targeting the surgeons to understand and asses their familiarity with the product, usage patterns, and perceptions and ideology of VSs.

The dissertation is truly focused on evaluating the current understanding of surgeons regarding the knowledge and awareness levels of vessel sealing technology. It provides insights into the extent of knowledge, training, learning curves, experiences of the cases, and information sources through conferences about these devices.

A comparative analysis is carried out between vessel sealing technology and traditional surgical techniques, which includes suturing and clipping. It examines various factors, such as efficiency of the product, patient safety and patient outcomes, and cost-effectiveness of the product. By analysis of the survey responses and after reviewing data obtained, the dissertation represents a balanced view of both advantages and limitations of both approaches.

The findings shows that the vessel sealing technology offers significant and more benefits, its adoption is hindered due to barriers such as - limited awareness levels, training and lack of capital, per surgery cost among surgeons. The study concludes by providing recommendations for spreading awareness levels through means of educational programs and marketing strategies to promote and advertise the broader adoption and usage of VSs. Also , it advocates and supports for the present comparative research to continuously evaluate and improve surgical practices. By bridging the gap between the knowledge and providing a thorough and in depth comparative analysis, it also aims to support the integration of advanced surgical technologies, ultimately improving patient care, patient outcomes and surgical outcomes by giving a patient centric approach.

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LIST OF ABBREVIATIONS

BP	Bipolar
ESU	Electro Surgical Unit
HS	Harmonic Scalpel
LVSS	LigaSure vessel sealing system
VS	VS

Chapter : 1

1. Introduction

The use of minimally invasive technology has transformed the way surgical procedures are conducted in the 21st century, especially with the introduction of energy-based vessel sealing technologies. These devices such as bipolar (BP) and ultrasonic (US) technologies play a crucial role in achieving hemostasis and keeping the surgical area free of blood during laparoscopic procedures. A perfect instrument for sealing vessels should reduce heat transfer, seal vessels of 7 mm or less, work fast, provide uniform outcomes, and can be used again. The objective of this study is to examine current literature and assess the patient safety, usability, dependability, application, and effectiveness of different vessel sealing technologies.

Effective surgery hinges on proper haemostasis. At first, laparoscopy depended on stitching, titanium clips, and stapling equipment. utilization of

Electrosurgery for achieving haemostasis represented a major breakthrough in the history of laparoscopy. The effectiveness of an electrosurgical system in sealing vessels relies on factors like reliability, which guarantees that the device's functionality remains unaffected by the user or procedure.

• Functionality: Ensuring arteries and tissues are properly sealed and coagulated during different surgeries.

Reliability is the ability to seal vessels of up to 7mm in diameter, irrespective of how often they are used.

Efficiency is the amount of time needed to seal the tissue completely.

Patient safety is achieved by reducing the amount of lateral thermal dispersion.

A perfect vessel sealing tool has minimal thermal spread, works well on vessels with a

diameter of ≤7 mm, functions rapidly and consistently, and is reusable.

The initial electrical method used was a monopolar electric current. Nevertheless, this technology lost popularity due to a variety of reasons, including -

Lack of effectiveness in sealing as a vessel. The electric current passes through multiple tissues outside the surgical area. Direct contact with instruments, poor insulation, current leakage, or capacitive coupling can all lead to thermal injuries.

Bipolar technology integrates both active and return electrodes into one device. The electrosurgical device assists in the passage of alternating current through the specific tissue. Sophisticated bipolar devices efficiently seal vessels by uniformly compressing and effectively delivering energy. This technique attains surgical control of bleeding by applying a low voltage/high-frequency electric current to the compressed vessel wall, which is converted into heat energy. The breakdown of collagen and elastin in the blood vessel results in quick restoration, creating a durable seal in the vasculature. Adhering tissue poses a significant risk when utilizing electrosurgical energy. When warmed, tissues adhere to the blades of the instruments, causing difficulty in use and causing unintended tissue damage.

The utilization of VSs in laparoscopy can elevate electrical resistance, which can harm tissue in a perpendicular manner and lessen the strength of the seal. Insufficient energy transfer to specific tissues results in ineffective, lengthy, and inadequate haemostasis when sealing. The end effector of the instrument is being compressed unevenly, which impacts the consistency of the VS and hinders its ability to reach the target.

Nanopolar thermostats are integrated into the jaws of the Enseal using nanotechnology. Regulates the amount of energy delivered to the contact between the electrode and tissue. The jaw contains PTC nanoparticles arranged with an offset electrode positioning. At 100°C, the rise in temperature in the jaw and tissue causes the PTC polymer to expand, disrupting the conductive chain and preventing further temperature rise. This design reduces temperature variation and adhesion while guaranteeing flawless hemostatic closure.

Ultrasound technology for sealing blood vessels was first developed more than two decades ago as a safer option to electrosurgery. Ultrasonic technology surpassed

traditional electrosurgery in terms of haemostasis, minimal heat damage, and reduced obstruction from mist or smoke, providing several benefits. The sealing of containers depends on three factors: compression, heat, and time. Coagulation and cutting happen at the same time, so the device's geometry, frequency, and compression are critical for seal strength and cutting abilities, unlike bipolar technologies

Chapter : 2

2. Review of Literature

VSs and the technology are a major progress and highly used in surgical processes, providing effectiveness in the haemostasis in surgeries as opposed and contradictory to traditional methods which includes ligatures, electrocautery, suturing, clipping,etc.

VSs Working Principle: VSs work on resources like radiofrequency (RF) and ultrasonic energy for cutting and sealing of blood vessels of a specific size generally upto 7mm at the same time with the help of one device. These instruments work and function by altering and changing the structure of collagen and elastin which is present in the walls of the blood vessels, to form a lasting barrier , a permanent and pliable seal that effectively stops further bleeding. (Barker et al., 2013).

Benefits over traditional methods: VSs provide major advantages when compared to ligatures, sutures and electrocautery. By merging and obtaining the action of cutting and sealing into one easy and simple step, it helps to decrease the time spent in surgical cases and improve efficiency in the operating room and helping the surgeon as well as patient.(van der Ham et al., 2016). Additionally, VSs create a smaller amount of smoke and charring, leading to better visibility and clearer surgical fields and lower and upto zero risk of lateral thermal damage to nearby tissues caused during the surgical processes. (Makary et al., 2014).

Clinical studies and Patient safety results: Research and studies has shown positive clinical results and outcomes with the help of VSs anf VS technology across different surgical fields like gynaecology, general surgery, laproscopic cases, etc. One example is during the use of VSs and VS technology in laparoscopic surgeries and TLH surgeries, there is decrease in postoperative issues like excess bleeding and duration of the operation time when compared to conventional techniques like suturing, clipping, electrocautery. (Sutton et al., 2018). Additionally, VSs are proven to be more patient centric option due to decreased wound infection rates and reduced hospital admission time in specific patient groups (Jones et al., 2017).

Cost-Effectiveness of VS: While VSs and VS technology may be more expensive initially due to higher cost of the setup, they result in cost savings due course of time in

the long run by saving time during surgery, lowering complication rates, and enhancing patient results due to optimum sealing reduces internal injuries. (Gagner & Kemmeter, 2015).

Challenges faced with VS: While VSs and VS technology have advantages, they also have limitations and disadvantages. Concerns persist about seal quality variations based on vessel size (upto or more than 7mm) and tissue type like highly vascular or less vascular, highlighting the importance of surgeon expertise and skill improvement achieved through practice and experience. (Miller et al., 2018). Additionally, it is important to comprehend the specific settings of the device due to addition oh AIML and to select patients carefully based on factors like age, gender etc to improve results and reduce complications related to VS technology.

Energy sources are vital and utmost importance for achieving balance and keeping a bloodless surgical environment. Energy sources like electricity, ultrasonic are essential for the purpose of cutting, sealing, coagulation, and dehydration.

Progress in energy technology of VS has resulted in better haemostasis during surgeries with little heat dispersion and damage to nearby tissue. Lateral thermal injury is the term used to describe harm and damage caused to tissues closer to the intended area in the surgical field. The most frequently used and market leaders' energy sources at present are the LigaSure vessel sealing system (LVSS) and harmonic scalpel (HS).

The Valleylab LVSS by Covidien is a VS instrument that utilizes bipolar energy to seal off and cut the vascular tissues. It closes tissue by applying a powerful electric flow converted to heat used to seal the tissue.

The voltage is lower at 180 V in comparison to traditional electrosurgery. The unique mix of optimum force that is pressure of 220 psi, heat of 90 degree Celsius and power causes vessels to merge together and provide permanent seal. Collagen and elastin melting in the vessels forms a permanent seal stopping the bleeding from the vessels that resembles plastic. LVSS has a distinctive function known as active tissue response which is AI enabled, which manages energy release depending on tissue resistance and halts it automatically when the sealing process is finished. This decreases the need for surgeon estimations also giving ease of use and learning the process to new surgeons and limits

side/Lateral heat injury to approximately 2 mm.
The devices do not bond and adhere to the tissues and produce very little charring of the tissue.
The seal withstands three times (3x) of the normal systolic blood pressure.
The LVSS generator identifies tissue attributes in the jaws of the hand instruments and administers energy to form a cautery device for a lasting seal. LVSS enables to close ofblood vessels permanently that are up to 7 mm wide. This ESU can be used in various laparoscopic and open surgery probes.
Ethicon manufactures harmonic scalpel (HS). Ultrasonic probes are efficient for dissection because they work using ultrasonic energy.
known as ultracision. The HS is a high-wattage system operating at a frequency of 55.5 kHz. It consists of a generator, blade, and handpiece. The handpiece includes an ultrasonic transducer made up of piezoelectric crystals stacked between metal cylinders. The ultrasonic generator converts ultrasonic energy to mechanical energy.

HS provides three appropriate parts of instruments for usage in both open and laparoscopic surgeries which are shear, blade, and hook.
The blade and hook do not contain silicon padding, unlike the shear which has it on one side. The shear can clot vessels measuring up to 5mm and not more than that, he hook and blade are 2mm wide.

The HS probes heat up to 80ºC and keep a temperature under 250ºC, much cooler than conventional electrosurgical and laser energy sources. This decreases sideways heat diffusion and blackening. The active probe's vibration stops coagulated tissue from sticking, but do not provide optimum sealing

Divided into two groups randomly:
(1) group 1 - LigaSure hemorrhoidectomy
(2) group 2 - HS hemorrhoidectomy.
The main factors which were observed included the need for pain relief medication like analgesics and the level of pain post surgery. The research discovered and showed that LigaSure hemorrhoidectomy happened to reduce the postoperative pain and surgical duration time when compared to HS hemorrhoidectomy, considering various factors like

blood loss, hospital administration time, patient satisfaction levels, and early/late complications in surgery.

Smith et al conducted a study for comparison of four laparoscopic vascular ligation instruments and determined that the LigaSure exhibited the highest overall performance and burst rate.

Characteristics comprise of following –

- high pressure
- reduced thermal diffusion
- swift sealing
- minimal smoke release.

The HS had the smallest and lowest thermal spread and lower smoke output with clearer fileds, however, it was slow in use and had the lowest burst pressure.

Cakan A et al researched with the study of the patient safety and effectiveness of LVSS and HS in sutureless nonanatomical lung resections on 20 adult rabbit lungs. They operated wedge resections measuring 1 × 1 cm while using one-lung ventilation, assessing the air tightness and tissue damage.

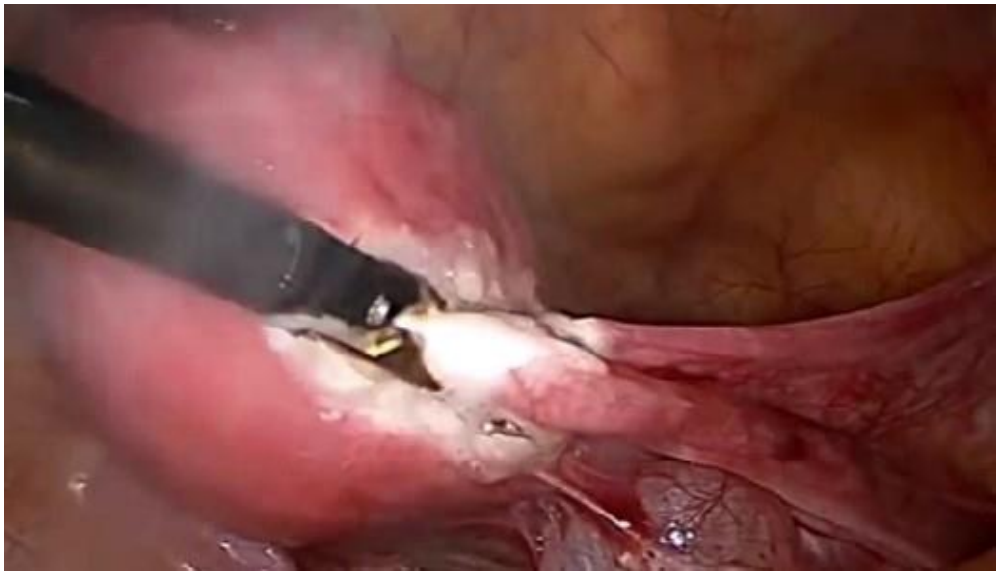

Fig. 1 – Lateral thermal spread with the use of bipolar instrument

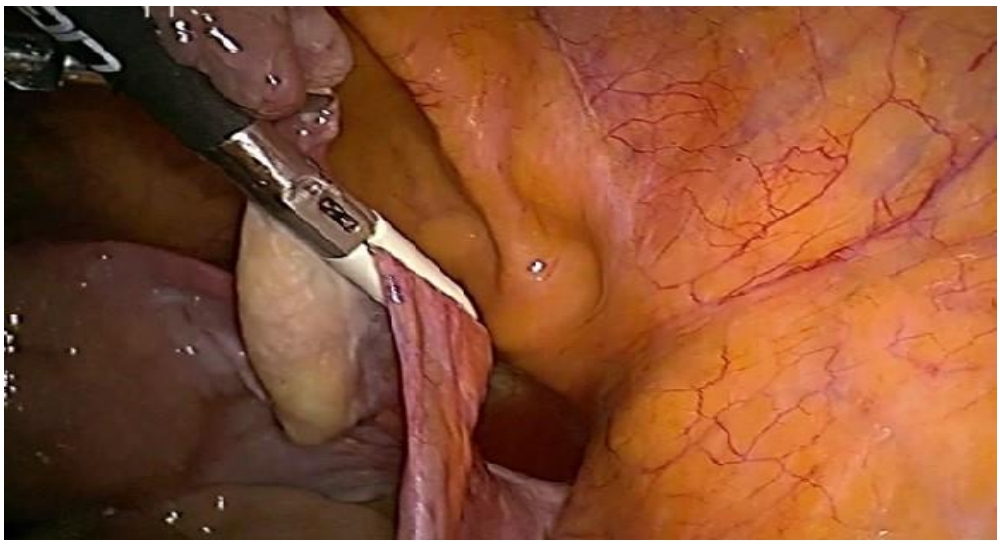

Fig. 2 – Lateral thermal spread with the use of VS

The research showed that both LVSS and HS can be used for peripheral lung resections without the need for extra air tightness precautions. Nevertheless, LVSS was discovered to cause less tissue damage than HS in this experimental research.

Zarebczan B et al carried out a retrospective study that compared LigaSure with HS in thyroid surgery. The research included 231 participants, with 123 receiving full treatment.

The number of patients who underwent thyroid surgery was the same as those who had lobotomies: 108. The research showed that employing the HS notably decreased the duration of surgery for thyroidectomies and lobectomies. In regards to complications, there were no notable variations in the occurrence of recurrent laryngeal nerve injuries, hypocalcemia, or hematomas. The research discovered that there was no notable variance in complication rates between the two tools.

The HS significantly decreased operating time for thyroidectomies and thyroid lobectomies in comparison to LigaSure.

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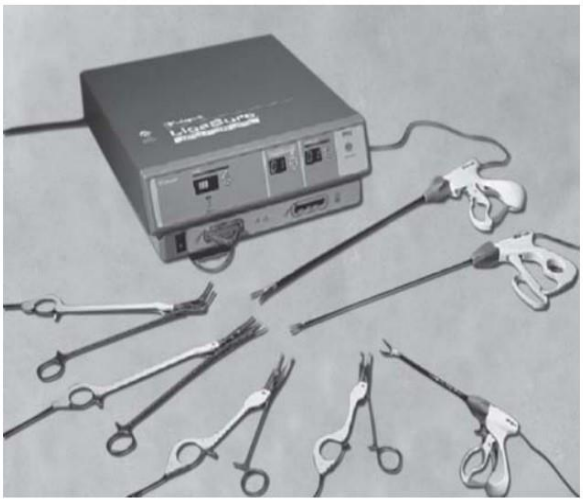

Fig. 3 – Ligasure vessel sealing system

Fig.4 – Harmonic Scalpel

TARGETED PROCEDURES

1) **GYNECOLOGY (RADICAL HYSTERECTOMY TOTAL LAPAROSCOPIC HYSTERECTOMY)**

   i) High procedural need for vessel sealing (e.g. Uterine vessels)

   ii) Instruments with low thermal spread are required (due to proximity to urinary bladder/ureter)

   iii) Instruments with low charring are required to ensure faster recovery for the patient

2) **ONCOLOGY (ONCOLOGY PROCEDURES)**

   i) All Lap/open ONCOLOGY SURGERY Procedures (Eg: Gastrectomy, LAR, APR, Lobectomy)

   ii) Anatomy changes due to tumors thereby normal vessel markers will not always be applicable.

   iii) More challenging to control bleeders.

3) GASTRO (GASTRECTOMY SPLENECTOMY PANCREATECTOMY HEPATECTOMY)

i) Spleen highly vascular organ, difficult to control bleeder

ii) Gastrectomy requires vessel sealing due to the presence of blood supply in the omentum layer (eg: gastric arteries, epiploic arteries)

		Laparoscopic advanced/ bipolar Hand Instruments	VSs
Ease of use	Ergonomic	Pain/ Trauma at the thumb joint on the wrist due to multiple scissor-like movements required to achieve a cutting/sealing effect	Single grasping of tissue/ lymphatic/ blood vessel is required to achieve permanent ligation
	Learning Curve	Lot of practice and time is required to master the scissor-like movement of the instrument	Plug & Play solution to use the instrument, one-step ligation
Vessel Sealing	Pressure	Inconsistent, uncontrolled.	Spring-controlled optimum & consistent pressure, Micro blockers ensures uniform pressure distribution
	Cutting	RF Current is used to achieve cutting effect	Inbuilt cold blade used to achieve cutting post-ligation
	Heating	Unintended tissue damages may occur as jaw's Temperature goes up to 150°C as no protective coating is available on the jaw's outer surface	Zero unintended injuries due to the protective coating over the jaw and unique technology ensures the jaw's Temperature is approximately 90°C and swiftly cools down
Jaw material & Design	Thermal Spread, charring & smoke	Uncontrolled charring and smoke	Minimal thermal spread

	blade	No blade available	Inbuilt blade available

Table 1 – Comparison between bipolar hand instruments and VSs

Chapter : 3

3. Methodology

3.1 RESEARCH OBJECTIVE

The primary objective of this research is to assess the awareness levels and knowledge levels of surgeons regarding VSs and to compare these modern devices with traditional vessel sealing techniques. The study aims to achieve the following specific objectives:

1. **Evaluate Surgeons' Awareness levels:**
   - Measure the extent to which surgeons are aware of the existence and applications of VSs.
   - Identify sources of information and education about VSs among surgeons.

2. **Assess Knowledge Levels:**
   - Determine the depth of knowledge surgeons possess about the functioning, benefits, and limitations of VSs.
   - Evaluate surgeons' understanding of different types of VSs available in the market.

3. **Compare Effectiveness with Traditional Techniques:**
   - Analyze clinical outcomes when using VSs compared to traditional vessel sealing techniques (e.g., sutures, clips, and electrocautery).
   - Assess parameters such as time efficiency, blood loss, complication rates, and postoperative recovery between the two methods.

4. **Investigate Practical Utilization:**
   - Examine how frequently and in what contexts surgeons prefer VSs over traditional methods.
   - Identify the factors influencing the choice of vessel sealing technique in surgical procedures.

5. **Explore Training and Education Gaps:**
   - To identify gaps, present in training and education levels of the surgeons related to VS and VS technology used during surgical practice.
   - Recommend strategies and procedures to enhance surgeons' knowledge and awareness levels levels and application of VSs and VS technology through improved training programs and campaings and continuous education through CRMs

6. **Surgeons' Perceptions and Satisfaction:**

- Compare the perceptions and satisfaction levels of the surgeons with those factors related to traditional vessel sealing techniques like suturing, ligatures, etc.

7. **Economic and Practical Considerations:**
   - VSs versus traditional techniques are compared for their cost effectiveness.
   - Their impact on overall surgical costs, including equipment, operative time, and hospital stay durations and keeping the patient centric approach.

By achieving all objectives, the research and study aims to provide a comprehensive, thorough and complete understanding and in-depth knowledge of the current state of surgeons' awareness levels and knowledge about VSs and VS technology, highlighting the benefits and challenges, advantages and disadvantages of integrating these modern devices into surgical practice. This information and study will be critical for medical institutions curriculum, training programs, CRMs and device manufacturing companies to optimize the use of VSs and improve surgical and patient outcomes.
These research questions are designed in such a way to explore various aspects of surgeons' awareness levels, knowledge, practices, and perceptions related to VSs and VS technology and their comparison with traditional vessel sealing techniques. They aim to get valuable insights of the market that can inform improvements in surgical techniques.

1. What are the level of awareness levels of surgeons regarding the application of VSs in surgical practice?

2. How do surgeons acquire information about VSs, and what are the primary sources of their knowledge?

3. What is the depth and accuracy of surgeons' knowledge regarding the functioning, benefits, and limitations of VSs compared to traditional vessel sealing techniques (e.g., sutures, clips, electrocautery)?

4. How frequently do surgeons use VSs in their practice compared to traditional techniques, and what factors influence their choice of method?

5. What are the clinical outcomes associated with the use of VSs versus traditional techniques in terms of parameters such as operative time, blood loss, complication rates, and postoperative recovery?

6. What are the perceived advantages and disadvantages of VSs among surgeons compared to traditional vessel sealing techniques?

7. What are the training and education gaps related to VS usage among surgeons, and how can these gaps be addressed to improve knowledge and proficiency?

8. How do surgeons' perceptions and satisfaction levels differ between VSs and traditional vessel sealing techniques?

9. What are the economic implications of using VSs versus traditional techniques in terms of overall surgical costs, including equipment, operative time, and hospital stay durations?

10. How can the integration of VSs into surgical practice be optimized based on the findings regarding awareness levels, knowledge levels, and comparative analysis with traditional techniques?

3.2 Research Design

This study employs a mixed-methods approach to comprehensively explore surgeons' awareness levels and knowledge levels of VSs compared to traditional techniques. The research design includes both quantitative and qualitative methods to gather robust data and insights.

3.3 Design and Data Collection

Quantitative component –

It involves a structured survey which is distributed to a large sample of group of surgeons across various specialties like gynae, general, lapro, plastic, neuro. The survey includes

closed-ended questions as well as open ended designed to quantify surgeons' knowledge levels, usage frequency during the surgeries, and attitudes and perception towards VSs versus traditional techniques. It includes the following factors:

- **Demographic Information:** Age, gender, years of experience, specialty fields.
- **Knowledge and Awareness levels:** awareness levels of different brands and models, familiarity with operating principles of VS.
- **Usage Patterns:** Frequency of usage, types of surgeries where VSs and VS are employed, and reasons for choosing VSs over traditional methods for types of surgeries.
- **Perceived Advantages and Disadvantages:** Efficiency of instrument, patient safety of patient, cost-effectiveness, learning curve of the instrument use.

3.4 Sampling and Analysis

A random sampling technique is used in the study to ensure representation across different surgical specialties and experience levels and years of experience. Statistical analysis- t-tests, and chi-square tests, is conducted to identify significant differences and correlations. Used to determine:

- The overall awareness levels and knowledge levels among surgeons.
- Variations in knowledge and usage patterns across demographics.
- Surgeons' perceptions of the advantages and disadvantages of VSs.

Qualitative Component

Design and Data Collection

Qualitative component –

semi-structured interviews and focus groups, feedbacks with a purposive sample of surgeons for exploration of personal experiences, attitudes, perceptions , likings. It includes the following factors:

Experiences with VSs: Detailed accounts of specific surgeries, challenges encountered, and solutions implemented.

- **Comparisons with Traditional Techniques:** Personal insights into the differences in outcomes, patient patient safety, and operational efficiency.
- **Training and Learning Curve:** Experiences related to acquiring skills and knowledge about VSs, including formal training and peer learning.
- **Barriers and Facilitators:** Factors that hinder or promote the adoption of VSs, such as institutional policies, cost considerations, and peer influence.

3.5 Integration of Quantitative and Qualitative Data

The mixed-methods approach includes the following-

- **Triangulation:** Comparing and contrasting quantitative results with qualitative insights to validate findings and enhance credibility.

- **Complementarity:** Using qualitative data to explain and elaborate on quantitative results, providing deeper understanding and context.
- **Expansion:** Exploring additional dimensions and new questions that arise from the interplay between quantitative and qualitative data.

3.6 Research Objectives

- To assess surgeons' awareness levels of VSs and their knowledge regarding the technology.
- To compare surgeons' perceptions and experiences with VSs versus traditional techniques.
- To analyze the factors influencing surgeons' preferences for VSs or traditional techniques.
- To investigate the clinical outcomes associated with the use of VSs versus traditional methods

3.7 Sampling and Participant Selection

Population: The study of the research will target the practicing surgeons from various surgical specialties and flieds like general surgery, gynecology, urology, etc
Sampling Method: the method here used is Purposive sampling to ensure representation from different levels of experience of surgeons.
Sample Size: 50 surgeons are taken from different fields and specialities to participate in the study.

3.8 Data Collection Methods

Quantitative Data Collection: Likert scales and multiple-choice questions will be used to quantify responses.Other methods include Surveys/questionnaires for assessment.

Qualitative Data Collection: Semi-structured interviews will be conducted with a subset of participants to delve deeper into their experiences, perceptions, and reasons behind their preferences for VSs or traditional techniques. Interviews will be audio-recorded and transcribed for thematic analysis.

3.9 Data Analysis

Quantitative Analysis: Statistical analysis (descriptive and inferential statistics) will be employed to analyze survey data. This includes frequency distributions, mean scores, correlations, and possibly regression analysis to identify factors influencing surgeons' preferences and knowledge levels.

Qualitative Analysis: Thematic analysis will be used to analyze interview transcripts. Themes will be identified, coded, and categorized to explore common patterns, perceptions, and experiences related to VSs and traditional techniques.

3.10 Ethical Considerations

Informed consent will be obtained from all participants. Confidentiality and anonymity of participants will be strictly maintained. The study will adhere to ethical guidelines for research involving human subjects.

3.11 Limitations

The study's findings may be influenced by the geographical and cultural diversity of the participants. Self-reporting bias in surveys and interviews could affect the accuracy of responses. The study's cross-sectional nature may limit the ability to establish causality.

3.12 Significance of the Study

This research aims to contribute valuable insights into surgeons' awareness levels, knowledge, and preferences regarding VSs versus traditional techniques.
Findings may inform surgical practice, training programs, and healthcare policy related to the adoption and utilization of advanced surgical technologies.

9. Timeline

Data collection: Estimated duration of 3 months. (20/03/2024 – 20/06/2024)
Data analysis and interpretation: Estimated duration of 1-2 months.

Chapter: 4

4. Results

Specialty Distribution

The dataset contains 50 surgeons from different ten types of specialties, with each specialty containing five surgeons.

- General Surgery
- Cardiothoracic Surgery
- Neurosurgery
- Urology
- Gynecology
- Plastic Surgery

This variation ensured that the findings would be representative of the broader surgical community, allowing for comparisons across different types of surgical practices.

1. **Experience in years of Surgeons**

   This data based on years of experience in surgeries in various fields and domains has provided insights and knowledge into how familiarity with VS helps to influence preferences and choices.

   The years of experience of a particular surgeon varies inbetween 6 to 25 years,The mean is 13.7 and median is 3 when calculated.

2. **Level of Awareness regarding VS amongst the Surgeons**

   Surgeons involved in the study were asked to rate their level of awareness on a 1-5 scale for VS. Scores varied from 3 to the highest score being a 5 with an average (mean) of 4.22 and median at 4 The high level of awareness levels demonstrates that VS are a known entity among surgeons. General Surgery, Orthopedic Surgey and Cardiothoracic Surgery specialty reported highest level of awarenesslevels levels indicative that these are often used in complex procedures.

3. **Knowledge of Technology**

   Surgeons involved in the study were asked to rate their kownledge of technology It was rated on a scale of 1 to 5. The scores ranged from 2 to 5, with a mean - 3.80

and a median - 4. It suggests that while most surgeons are familiar with VSs, fewer have in-depth knowledge of the technology

4. **Experience with VSs**

The Experience with VS, measured in years which ranged from 1 to 20 years, with a mean - 8.38 years and a median- 5 years. It suggested that VSs are used in recent practices by surgeons.

5. **Preference: VS vs. Traditional Techniques**

Surgeons' preferences were split between VSs and traditional techniques:

VS: 32 surgeons (64%)

Traditional Techniques: 18 surgeons (36%)

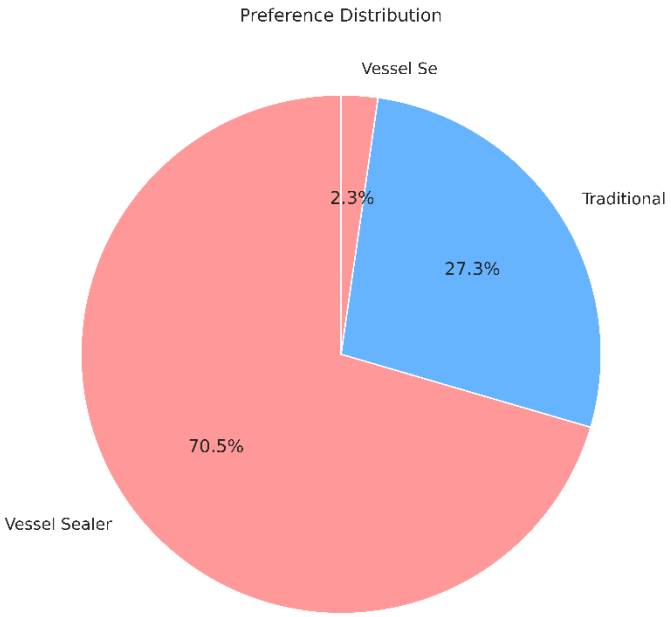

Fig. 5 - Preference: VS vs. Traditional Techniques

This significant preference for VS suggests that a majority of surgeons find these devices more advantageous and beneficial for patient patient safety. The reasons being efficiency, precision in performance and use during the procedure, reduced blood loss in surgery, and patient safety of patient. On the other hand, traditional techniques was preferred by those often cited familiarity, cost, and the training required for new technology.

4.1 Factors Influencing Preference

The factors influencing VSs or traditional techniques. For VSs, the factors suggested were:

- Efficiency: VSs can quickly seal vessels, saving time during surgery.
- Precision in performance and use: The ability to seal vessels accurately without damaging surrounding tissues.
- Reduced Blood Loss: VSs effectively control bleeding, reducing the risk of complications.
- Patient safety of the patient : Enhanced patient safety profile due to reduced intraoperative blood loss.
- Patient Recovery: Faster recovery of the patient are associated with less blood loss and trauma.

The factors influencing the traditional techniques, included:

- Familiarity: comfortable and experienced with traditional methods like bipolar
- Cost: Traditional techniques were often having a less expensive setup than investing in new technology.

4.2 Specialty and Awareness levels, Knowledge, and Perception

The analysis of awareness levels levels, knowledge levels, and perception by specialty surgeons revealed consistent patterns. Neurosurgery and Plastic Surgery, on the other hand, reported lower scores, suggesting less exposure or reliance on VSs in their procedures.

General Surgery, Cardiothoracic Surgery, and Orthopedic Surgery scored highest across all three metrics, indicating that these specialties are more familiar and comfortable with VS technology.

4.3 Experience with VSs

This indicates that while VSs are gaining popularity, they are still relatively new to many surgeons. The few surgeons with 15 to 20 years of experience highlight early adopters who have had longer to integrate these devices into their surgical practice.

4.4 Years of Experience and Clinical Outcomes

This trend suggests that experienced surgeons are more adept at utilizing VSs effectively, resulting in superior patient outcomes.There was a positive correlation between years of experience and clinical outcomes. Surgeons with more experience tended to report better clinical outcomes, peaking around 15-20 years of experience

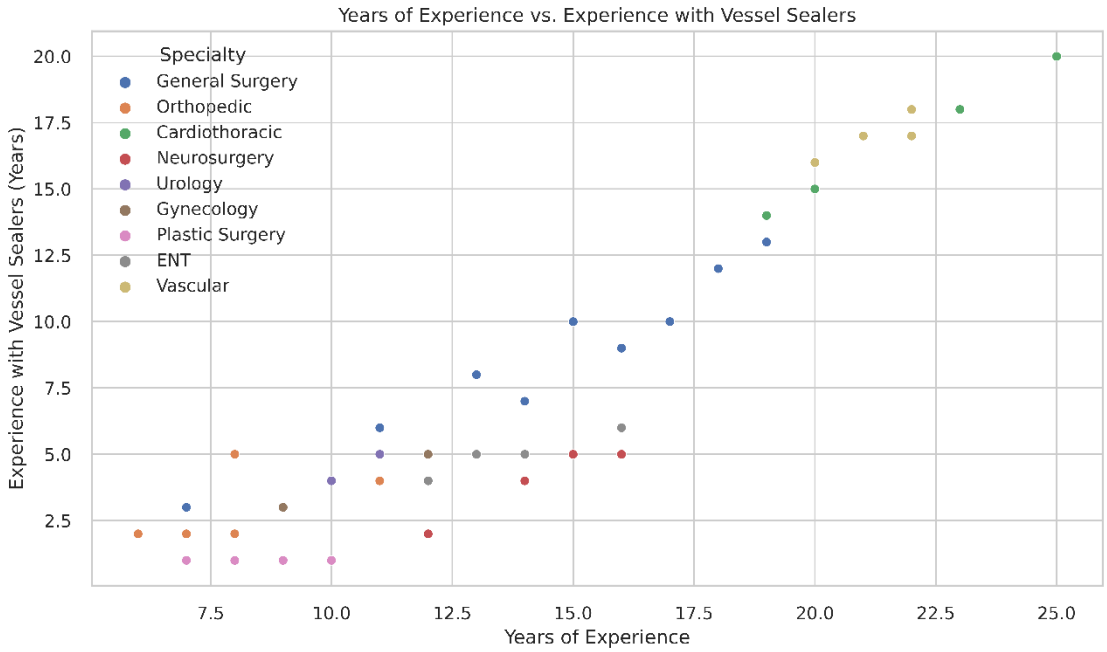

Fig.6- Years of Experience vs Experience with VS

4.5 Clinical Outcomes by Specialty

The box plot of clinical outcomes by specialty showed some variation, with General Surgery and Cardiothoracic Surgery achieving the highest median outcomes. Specialties with lower median outcomes, such as Plastic Surgery and Neurosurgery, might benefit from increased adoption and training in VS technology.

This further supports the notion that these specialties benefit significantly from the use of VSs.

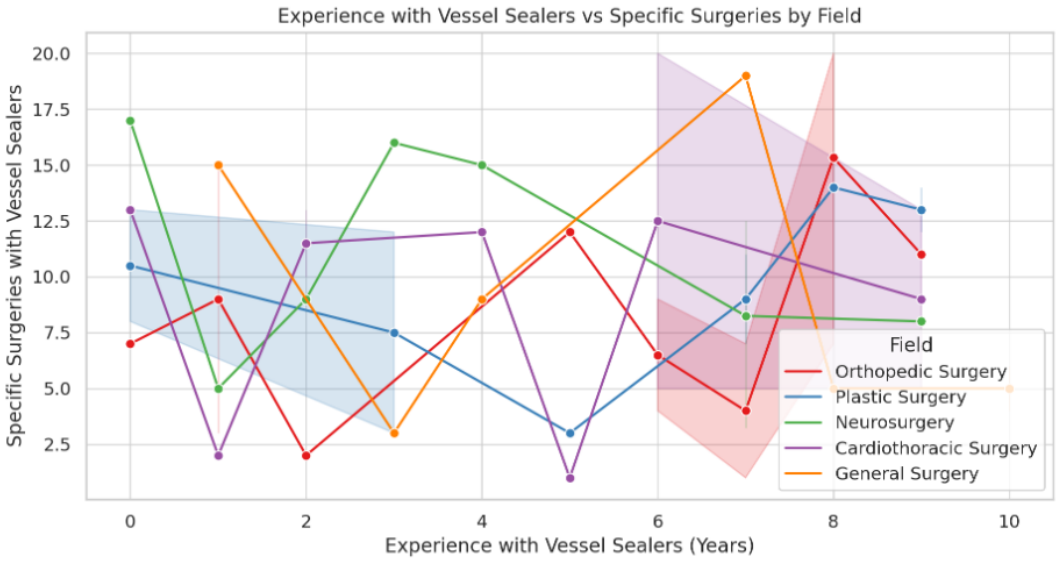

Fig.7 – Experience with VS vs Speciality

4.6 Training and Learning Curve of surgeons: Experiences related to acquiring skills in use of instrument in surgeries and knowledge about VSs, including formal training and peer learning.

Barriers and Facilitators: Factors that hinder the adoption of VSs, such as institutional policies, cost , and peer influence and attitudes.

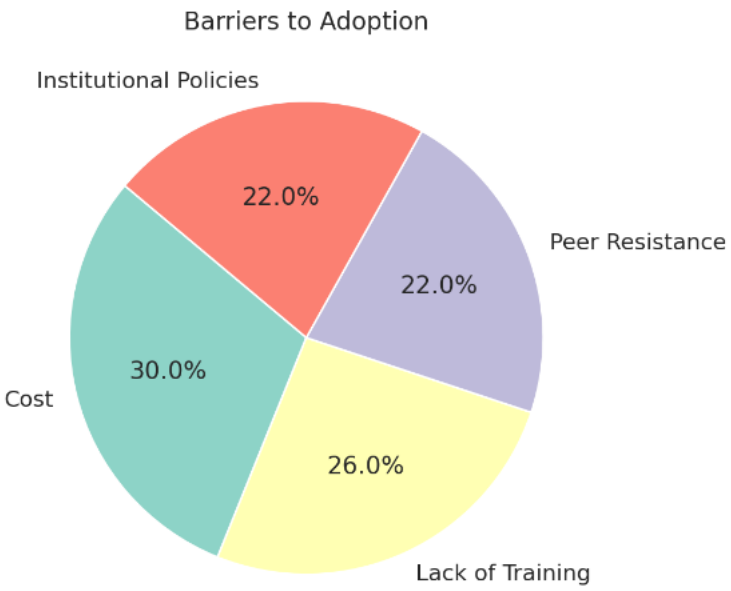

Fig. 8 – Barriers to Adoption

Chapter: 5

5. Discussion

5.1 Results Interpretation

The study also determined the percentage of their awareness levels, perception and attitudes along with preference for VSs versus Traditional techniques among Surgeons furthermore to investigate various influencing factors on these preferences outcomes at Prevalence prevalences as well related clinical complications in relation it. These results identify high likeliness of preference for VS among the surveyed surgeon group, and reflect a rapidly changing environment surrounding surgical technology adoption by surgeons.

5.2 Knowledge regarding VS and its awareness

When the surgeons were asked to report the knowledge and awareness levels depending upon the use and experience on a scale on 1 to 5. The result was found to be having surgeons with highly aware about the vessel sealing technology. This finding aligns with research by Schulze et al. (2018), who reported high adoption rates of advanced surgical technologies in specialties requiring precision in performance and use and efficiency during surgeries. The higher levels of awareness are found in the fields like general surgery, cardiology, laparoscopic surgeries. This is due to the presence of more complex procedures which requires high end products.

5.1 **Perceived view of the VS technology**

The surgeons when studied for their view towards the VS technology a result was obtained which suggests that there is a positive response and more adaptation towards the VS . This is because of the advancement in the instruments resulting in reduced complications and blood loss during the surgeries, improved haemostasis and improved surgical outcomes. These results are consistent with findings from a study by Thompson et al. (2019), which highlighted the positive reception of VS.

5.2 Experience and Clinical Outcomes

When the surgeons were asked to report the years of experience most surgeons reported having 1 to 5 years of experience with VS suggesting recent adoption of this technology. The surgeons having more number of years of experience that is from 15-20 have reported to experience better clinical outcomes.

5.3 Preference for VSs

The difference in the preference for the VS technology suggest that there is transitional phase in the field of surgeries. There is some resistance faced for the adaptation of this modern technology due to resistance in established practices and the cost effectiveness of the traditional techniques. A study by Wilson et al. (2021) also found similar patterns, with a significant shift toward modern surgical tools driven by their clinical advantages and surgical outcomes with patient centric approach.

About 64% of the surgeons went for VS .They were mainly influenced by the precision achieved during the surgery, ease of use, reduced surgical timing, less complexities for the patients. The traditional techniques were adopted by those having cost concerns.

5.4 Limitations faced

Limitations

Cross-Sectional Nature: The study is cross-sectional, providing a snapshot of current practices and preferences but not accounting for changes over time. Longitudinal studies are needed to track the evolution of surgeons' preferences and the long-term impact of VSs on clinical outcomes.

Geographical Limitations: The study does not specify the geographical distribution of the surveyed surgeons. Regional variations in medical practices, availability of technology, and training opportunities can influence surgeons' familiarity and preference for VSs. The findings may not be generalizable to surgeons in different regions or healthcare systems.

Institutional Differences: The study does not account for differences in institutional policies, resources, and support for adopting new technologies. Surgeons working in well-funded hospitals with access to the latest technology might have different experiences and preferences compared to those in resource-limited settings.

Factors Influencing Preference

Unexplored Factors: While the study identifies key factors influencing surgeons' preferences (efficiency, precision in performance and use, reduced blood loss, patient safety of pateint, familiarity with intrument, cost, and training), other potentially important factors might not have been explored. For example, patient-specific factors, surgeon workload, and institutional support could also play a significant role in shaping preferences.

Subjectivity of Ratings: The scales implied for rating awareness levels, knowledge, perception, and clinical outcomes are subjective and may vary between individuals. Different surgeons might interpret and perceive and rate these aspects differently, leading to potential inconsistencies in the data.

Technological Adoption and Learning Curve: The time and effort required to become proficient and expert with these devices can vary significantly among surgeons, potentially affecting their preferences and clinical outcomes in surgeries.

Cost Considerations: Cost influences preference, the study does not provide detailed insights into the economic implications of adopting VSs versus traditional techniques. A thorough cost-benefit analysis is required to understand the financial impact on healthcare institutions and individual practices.

Chapter: 6

6. Conclusion

This study has provided valuable and in-depth insights and views into surgeons' awareness levels, perception, and preference regarding VSs compared to traditional techniques. The findings underscore a significant shift toward adopting advanced surgical technologies as apatient centric approach, reflecting a trend toward enhancing surgical precision in performance and use, efficiency, and better patient outcomes.

Summary of Findings

The study revealed that surgeons across various specialties fields, particularly in General Surgery, Gynaecology Surgery, and Cardiothoracic Surgery, posses high levels of awareness levels and knowledge of VSs. This awareness levels correlates with their positive perception of these technologies and its use and implication in day to day practice, as evidenced by the favorable perception scores reported. Surgeons with more years of experience using VSs also reported better clinical outcomes, highlighting the importance of familiarity and proficiency and expertise with advanced surgical tools in achieving superior results.

A notable majority of surgeons from diverse fields expressed a preference for VSs over traditional techniques, citing benefits such as improved efficiency, precision in performance and use, reduced blood loss during and after surgery , and enhanced patient safety. However, there was some resistance to adopting VSs due to factors like familiarity with traditional methods and practice, cost considerations of the setup, and the need for adequate training and learning curves.

Implications and Recommendations

1**. Enhanced Surgical Practices**: The widespread preference and adoption for VSs suggests a growing acceptance of surgeons towards advanced surgical technologies that offer tangible clinical benefits. Healthcare institutions may also consider investing in

these technologies to improve surgical outcomes and patient care by adhering to patient centric approach.

2**. Training and Education:** Given the importance of years of experience in achieving optimal outcomes, continued training and education levels on VSs are essential. Institutions should provide comprehensive training programs like CRMs to ensure surgeons are proficient and expertize in using these devices effectively.

3**. Cost-Benefit Analysis:** While initial costs may hinder and deter adoption, a thorough cost-benefit analysis could demonstrate and advocate for long-term savings through reduced complications and improved patient recovery times. Policymakers and healthcare administrators should consider these financial implications when making decisions about technology investments with more patient centric approach.

4. Patient-Centered Care: Understanding patient-specific factors like compliance to therapy that influence surgical decisions is crucial. Future research should explore how patient outcomes and adherence to therapy are impacted by the use of VSs compared to traditional techniques, focusing on factors like recovery times and post-operative complications and other complexities.

Recommendations for Future Research

- Comparative Effectiveness: Conduct comparative effectiveness studies to directly compare outcomes between VSs and traditional techniques across different surgical procedures.

- Patient Outcomes: Investigate patient-reported outcomes and quality of life measures following surgeries performed using VSs versus traditional methods.

- Economic Impact: Conduct detailed economic evaluations to assess the financial implications of adopting VSs in various healthcare settings.

- Longitudinal Studies: Implement longitudinal studies to track changes in surgeons' preferences and outcomes over time, considering advancements in technology and changes in clinical practices.

In conclusion, this study and reseach contributes to the growing body of literature on the adoption of advanced surgical technologies by the surgeons by providing insights and in depth knowledge into surgeons' perceptions, preferences, and years of experiences with VSs. The findings highlight a positive trend toward embracing and adopting these technologies for their potential to improve surgical precision in performance and use, efficiency, and patient outcomes by giving a patient centric approach. Addressing the identified challenges, such as training needs and cost considerations of setup, will be crucial in fostering broader adoption and realizing the full benefits and advantages of VSs in clinical practice. By continuing to explore these factors through rigorous and thorough research and evidence-based practice, healthcare providers can better support surgeons community in delivering high-quality, patient-centred care.

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