

AWARENESS AMONG SURGEONS ON ELECTROSURGICAL UNIT: AN ESSENTIALITY OF SURGERY

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

Dr. Saurabh Kumar

2024

Completion Certification

CERTIFICATE

This is to certify that **AMRUTH S S** 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 his internship at **WINGLOBE HEALTHCARE PVT LTD** during **March 20 - June 20, 2024**.



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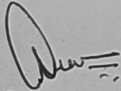
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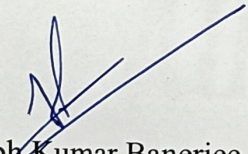


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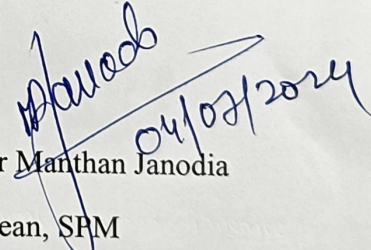
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ABBREVIATION

ESU	Electro Surgical Unit
PER	Power Efficiency Ratio
STST	Smart Tissue Sensing Technology
PRECQM	Patient Return Electrode Contact Quality Monitoring

ACKNOWLEDGEMENT

My Sincere Thanks to My Guide Mr. Anoop Sagar, National Sales Manager- India and Sub continent, Winglobe Healthcare Pvt Ltd for His Support and Encouragement During My Dissertation; That is His Guidance and Support That Has Enriched My Development as An Intern.

I'd Also Like to Thank My Mentor Dr Saurabh Kumar Banerjee, Associate Professor of SPM, IIHMR University, For His Support. I Am Grateful to Them for Providing Valuable Guidance Throughout the Examination, His Recommendations, Valuable Suggestions, Optimistic and Strong Support, without his Support This Dissertation Would Not Be Possible to Complete.

I Would Like to Extend My Thanks to WINGLOBE HEALTHCARE PVT LTD for Giving Opportunity as An Intern and Providing Market Insights Which Helped Me for My Dissertation Completion.

ABSTRACT

This Report is About the Electro Surgical Unit and Its Essentiality for Surgeries Provides an Overview of Indian Market of Electro Surgical Unit. This Report Shows an Overview of How Indian Electro Surgical Market is Developing Through Adapting Various New Technologies.

This Report Discusses on Various Functionalities of An Electro Surgical Unit Such As STST, PER, PRECQM Which Plays an Important Role in Best Surgical Outcomes.

This Report Compares the Indian ESU's and Discusses on the Segment and Surgical Specialties Where the ESU's Can Be Used for Best Possible Outcome

The ESU's Specially Focuses on the General Surgeries. Oncology, Gynecology, Cardiology, Plastic Surgeries, Urology, Gastro Intestinal Surgeries Segments.

We Will Discuss How ESU's have Their Importance in Providing Best Surgical Outcomes.

Keywords: Bipolar Surgery; Electrosurgical generator; Electrosurgical unit; Monopolar Monopolar; Return electrode

INTRODUCTION

The application of a high-recurrence electrical flow for tissue cutting and coagulation is known as electrosurgery. Coagulation is widely employed in the treatment of soft tissue tumors and other conditions involving large-scale tissue degradation, lumen-containing structures, and hemostasis.

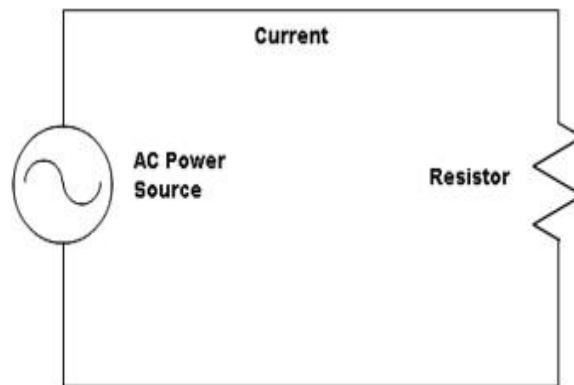


Fig.1

Fig.1 illustrates the relationship between the generator, active electrode, patient, and return electrode through a basic circuit that includes the ESU as the power source, the patient as a body of resistance, and wires connecting the two. The input current from the outlet is modulated by the ESU to make it appropriate for use on living tissue.

Radio Frequency electrical current is used to cut tissue and control bleeding caused by coagulation in an ESU. The Heating Impact of Tissue Resistance from High Amount of Current Leads to Tissue Destruction. Through cables and electrodes, electrical currents are sent and received. A footswitch or a hand piece switch can be used to activate the electrodes. A monopolar or bipolar mode may be used by the ESU.

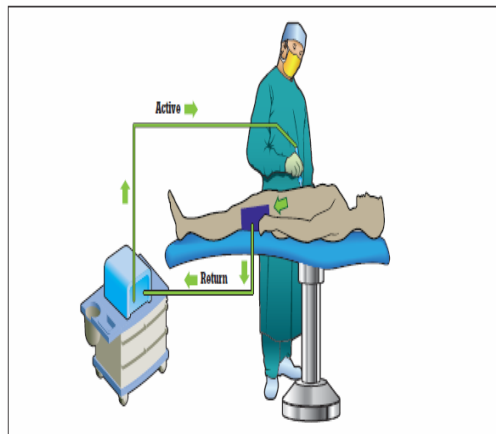


Figure 1:
Monopolar
electrosurgery

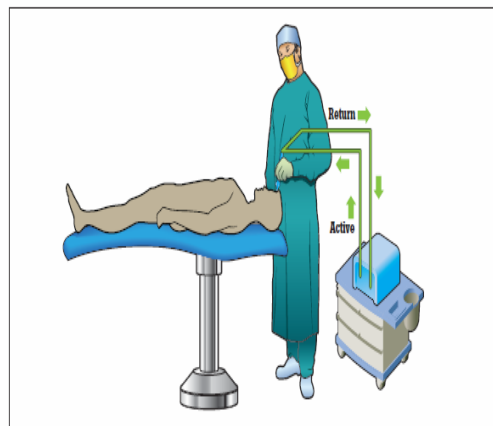


Figure 2:
Bipolar
electrosurgery

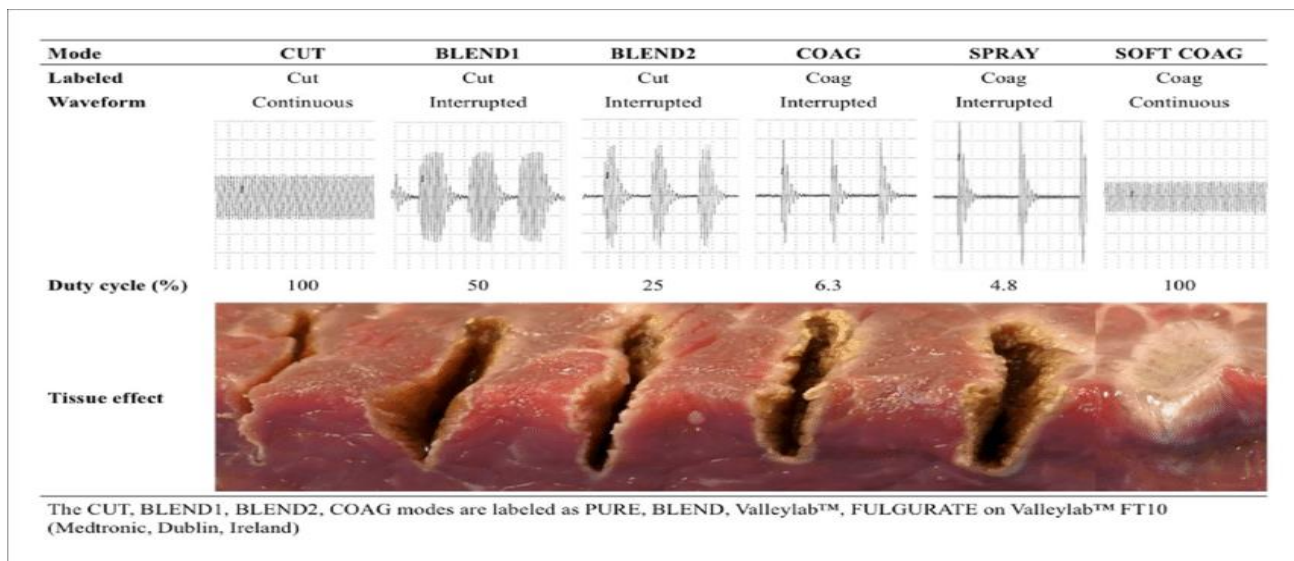
This Is the Representation of
Monopolar Electro Surgery and Bipolar Electro Surgery.

Monopolar technology involves the delivery of electrical current to the patient through an active cable and electrode. As depicted in Figure 1, the current is dispersed back to the unit through a return electrode pad or plate, preventing concentrated heat that could result in burns.

As shown in Fig. 2, the active and dispersive leads in monopolar mode are equivalent to two electrodes in bipolar mode, which are typically the tips of a pair of forceps or scissors.

In electrosurgery, tissue cutting, coagulation, desiccation, or fulguration are achieved through the transformation of electrical potential energy into thermal energy. The Conglutination of tissue due to fulguration or desiccation without any cutting effect is known as coagulation.

Direct contact between the active electrode and tissue results in desiccation, which dehydrates the tissue and denaturates the proteins. Fulguration is the process that causes carbonization and superficial coagulation when electrons leap, arc, or spark from the active electrode to the target tissue through liquid or air.



Power Setting:

The power settings needed by the ESU can change depending on the surgeon's needs, experience, and the properties of the tissue. For instance, a monopolar hook may be able to cut the bowel wall, dissect the gallbladder, and perform peritoneal incisions with an appropriate effect at 80 to 90 W of continuous current. In contrast, small bleeders or fat-cutting may be controlled with as little as 50 W of interrupted current. A power setting of 100 W in both interrupted and continuous waveforms is sufficient for ablating or resecting tissue during resectoscope surgery.

Distributive or Returned Electrodes

Split Return Electrodes:

The Active electrode transports current from the ESU to the patient, where it diffuses throughout the surgical site and through the patient's tissue. The current must be gathered and sent via the patient's second attachment back to the ESU in order to complete the circuit.

Coupled Electrodes for Returns:

The patient lies on large, reusable gel pads called capacitive-coupled return electrodes. These electrodes transfer current in a manner akin to the previously discussed cloud, lightning, and Earth concept because there's no physical contact with the conductive substance inside. Their dimensions are designed to maximize body contact and minimize current density.

Features of ESU

1. STST:

This Constantly Monitors the Varying Tissue Impedance and Controls the Energy Delivery to Create a wide range of Desired Tissue Effect. This Technology Dynamically Varies the High Frequency Current and Voltage Which Leads to Enhanced Performance Using Low Power Settings Resulting in Reduced Tissue Damage and Faster Recovery.

2. PER:

This Feature Plays a Main Role in Performance of an ESU. Through Delivering the Precise Energy. For Example, Whatever the Energy Generated by Input Lets Take 25W is Near to Same Amount of Energy Delivery is Seen at the Output.

3. PRE – CQM:

This Feature Monitors the Contact Quality of Return Electrode in Real Time. It Establishes a Baseline and Uses it as a Reference to Monitor the Contact Area Reduces, it Automatically Stops the Energy Delivery and Gives an Error Message with an Audible Alarm.

Radiofrequency and Radiofrequency Currents

In order to mitigate the adverse effects of muscle and nerve stimulation, high-frequency AC was employed. Parisian Jacques d'Arsonval (1891) showed that AC with a frequency of more than 10,000 hertz (Hz) could also raise tissue temperature without causing burns, muscular contractions, or pain, building on François Morton's 1881 findings that oscillating current at a frequency of 100,000 hertz (Hz) could flow through the human body without causing burns, spasms, or pain. Then, it was found that the square of current density and temperature elevation were correlated.

Modern ESUs use the frequency ranges 200 000 Hz to 5 000 000 Hz because they allow the desired thermal effects without producing muscle fasciculation or nerve stimulation. The energy used in electrosurgery is also referred to as radiofrequency (RF) or RF currents because it is within the AM radio wave range.'

Applying an active electrode can occasionally cause nerve stimulation or muscle spasm, indicating that interactions with surrounding tissues, gas, moisture, and other substances alter the frequency of the current. This process, called harmonic demodulation, may produce DCs by converting high frequencies to lower frequencies (100,000 Hz). Galvanic currents are electrical currents that stimulate muscles and nerves at a frequency of 100,000 Hz or greater. Despite the possibility of occasional inconvenience, the use of this RF range has reduced traumatic morbidity and significantly increased the effectiveness of electrosurgery.

While it is difficult to change the frequency of AC, it is much easier to create AC from a DC source at the desired frequency. Thus, the 60 Hz AC input is first converted to DC by the ESU, and then it is again converted to AC at a higher frequency. An oscillator, a component of the generator, makes this possible. By applying high-frequency AC through the active electrode, tissues can now be heated with little to no neuromuscular stimulation. Tissue effects are caused by temperature changes at and near the electrode.

LITERATURE REVIEW

- This Paper is on Bipolar Electrosurgery Focusing in its Development and Application in Minimal Invasive Procedures, The Technological Advancement that have Led to the Widespread Adoption of Bipolar Techniques, Emphasizing Their Advantages Over Monopolar Electrosurgery Such as Reduced Tissue Damage and Improved Safety.

(Rioux J. Bipolar electrosurgery: a short history 538–541)

- The Lack of Knowledge and Understanding of Electrosurgery Among Obstetrician and Gynecologist. The Gap in Training and Education, Which Could Lead to Improper Use of Electrosurgical Devices and Patient Safety Issues.

(Mayooram Z, Pearce S, Tsaltas J, et al. Ignorance of electrosurgery among obstetricians and gynecologists. Br J Obstet Gynecol. 2004)

- The Development of Surgical Current Generator Topic on Revolutionized Surgical Techniques by Allowing Precise Cutting and Coagulation with Minimal Blood Loss.

(O'Connor JL, Bloom DA. William T. Bovie and electrosurgery. Surgery. 1996 390–396)

- The Electro Surgery Including its Principles, Applications, and Safety Considerations, The Monopolar and Bipolar Techniques Their Advantages and Disadvantages. The Complications and Provide Guidelines for Safe and Effective use in Surgical Practice.

(Gallagher K, Dhinsa B, Miles J. Electrosurgery. Surgery. 2010 70–72)

- The Evolution of Surgery from a Craft Based on Empirical Knowledge to a Scientific Discipline. The History of Surgery and Development of Electrosurgery and Its Impact on Surgical Practices and Scientific Advancements have Transformed Surgery into a Precise and Effective Field.

(Wangensteen OH, Wangenstein SD. The rise of surgery: from empiric craft to scientific discipline. Minneapolis: University of Minnesota Press; 1978 21)

- The Study on Invention of Electrosurgical Generator, Bovie's Background his Collaboration with Surgeon and the Challenges he faced in Gaining Acceptance for his Technology.

(Goldwyn RM. Bovie: The man and the machine. Ann Plast Surg 1979; 135–153)

- The Principles and Techniques of Using Electrical Currents in Surgical Procedures. The Equipment and Methods used in Electrosurgery, Offering Insights into Early Adoption and Development of this Technology in Medical Practice.

(Kelly HA, Ward GE. Electrosurgery. Philadelphia: WB Saunder Company; 1932 1–9)

- The Study on the Principle of Electrosurgery Specifically for Gynecological Procedure. The Various Techniques, Indications and Safety Measures Necessary for Effective and Safe Use of Practitioners to Enhance Their Skills and Knowledge in this Area. (Philadelphia: Lippincott-Raven; 1997: 321–326.)

RESEARCH METHODOLOGY

1. Research Question:

1. How Satisfied Are You with the Performance of Indian Based Electrosurgical Unit?
2. Are You Aware of ESU?
 - ESU TECHNICALITIES
 - PER
 - STST
3. What Are the Factors Influence the Choice of ESU for Surgical Procedures?
 - COST
 - BRAND REPUTATION
 - EASE OF USE
 - TECHNICAL SPECIFICATION

2. Objective:

To Conduct a Comprehensive Analysis of Electrosurgical Unit Technology Trend and Market Dynamics.

3. Hypothesis:

By Emphasizing the Superior Qualities, Effectiveness and Safety Profile of Electro Surgical Unit and by Putting Strategic Marketing Initiatives to Work That are Catered to the Requirement of Healthcare Facilities and Professional.

4. Material and Methods:

- **Study Design:** Descriptive Type
- **Setting:** It Would be Primary Research with Goals of Compiling Data from Survey, Consultation, Interview on ESU to Surgeons of Different Specialty, OT Technician
- **Study Population:** Surgeons of Different Specialties
- **Sample Source:** Primary Research
- **Study Tool:** MS Excel by Analyzing the Survey of KOL and Surgeons
- **Duration of Study:** 3 Months
- **Sample Size:** 25 General Surgeon 25 Gynecology 25 Oncology 25 Cardiology 25 Gastro Intestinal Surgeons 25 Urology Surgeons
- **Sample Population:** 180 Surgeons

5. Operational Definitions:

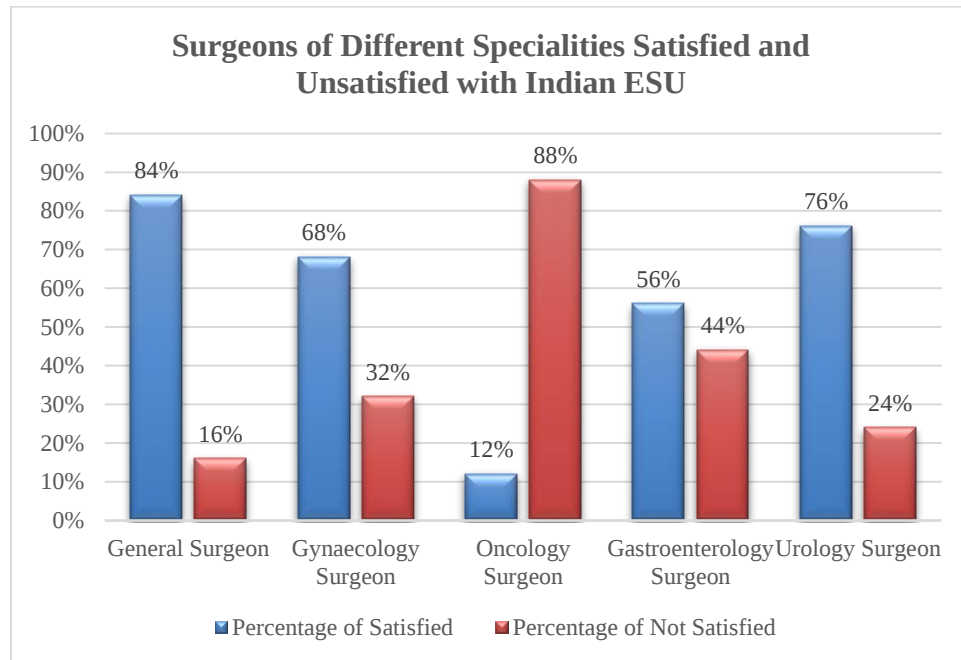
- “The Percentage of Surveyed Gynecologist, Oncologist, GI Surgeons Who Have Decided to use Indian ESU in their Practice is Adoption Rate”
- “Surgeon Belief on How ESU Enhances Their Surgical Procedure Efficiency, Outcomes and Patient Satisfaction and How User Friendly ESU’s are in Use with in Their Existing Surgical Practices is Perceived Usefulness and Perceived Ease of Use”

6. Ethical Consideration:

Ensure that all participants have given their informed consent and are aware of the purpose of the study as well as their right to withdraw at any time. By using codes to identify the participants' responses rather than personally identifiable information, you can guarantee their confidentiality and anonymity. An ethics committee will examine and approve the study to guarantee that research ethics are followed.

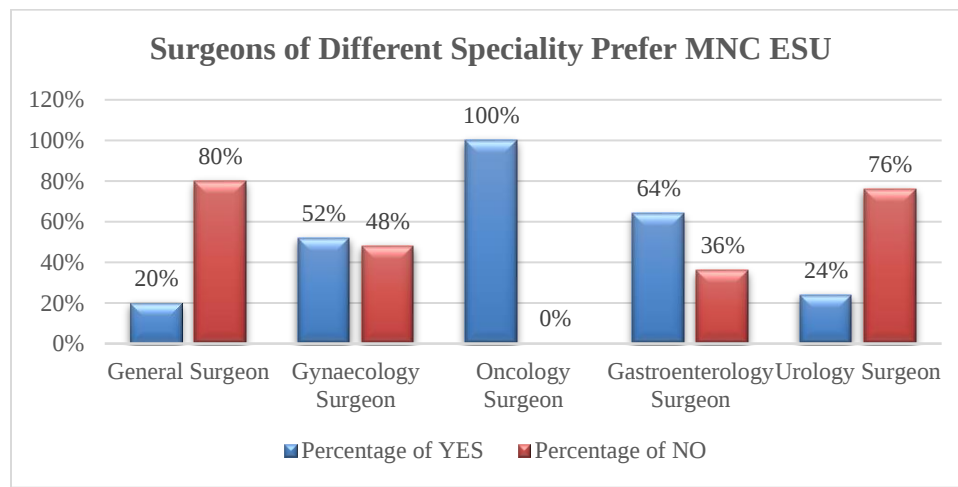
RESULT AND DISCUSSION

1. Surgeons Satisfied and Unsatisfied with Performance of Indian ESU



As Data Shows the Response of Sample Size of 25 Surgeons of Each Different Specialty Which Includes General Surgeon – 84% are Happy with Indian ESU and 16% are Not Happy with the Performance of Indian ESU, Gynecology Surgeon – 68% are Happy with Indian ESU and 32% are Not Happy with the Performance of Indian ESU, Oncology Surgeon – 12% are Happy with Indian ESU and 88% are Not Happy with Indian ESU, Gastro Surgeon - 56% are Happy with Indian ESU and 44% are Not Happy with Indian ESU, Uro Surgeon – 76% Happy with Indian ESU and 24% Not Happy with Indian ESU in Terms of Percentage.

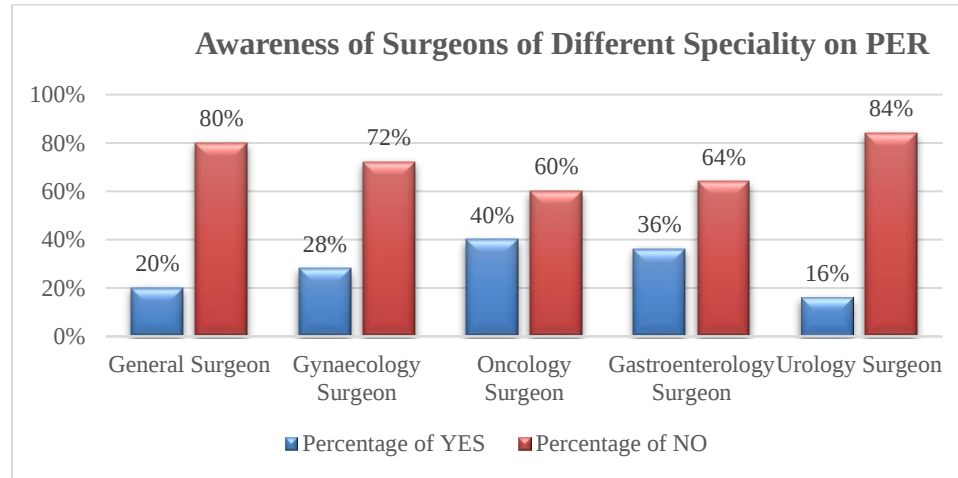
2. Surgeons of Different Speciality Prefer MNC ESU



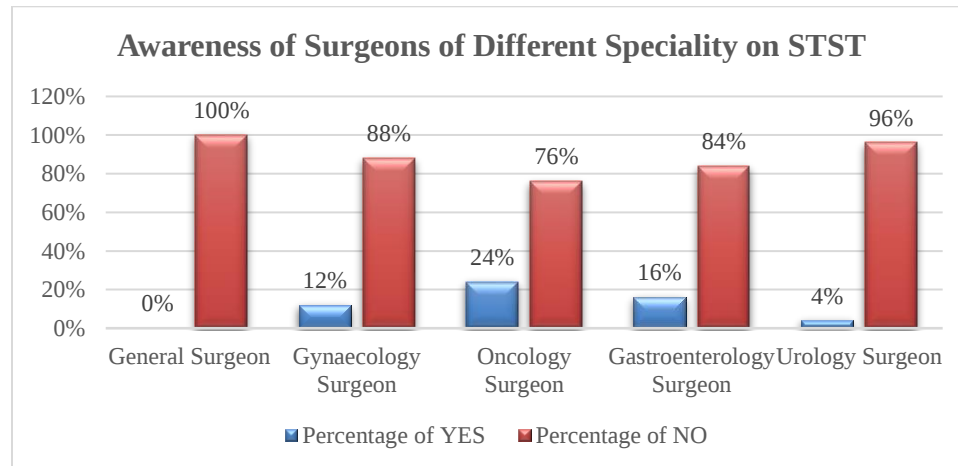
The Study Shows the Response of Surgeons of Each Different Specialty who Prefer MNC ESU's Than Indian ESU's. General Surgeon – 20% Prefer MNC ESU and 80% Do Not Prefer MNC ESU, Gynecology Surgeon – 52% Prefer MNC ESU and 48% are Do Not Prefer MNC ESU, Oncology Surgeon – 100% Prefer MNC ESU and Gastro Surgeon - 64% Prefer MNC ESU and 36% Do Not Prefer MNC ESU, Uro Surgeon – 24% Prefer MNC ESU and 76% Do Not Prefer MNC ESU.

3. Awareness on ESU Technicalities.

- Power Efficiency Ratio:



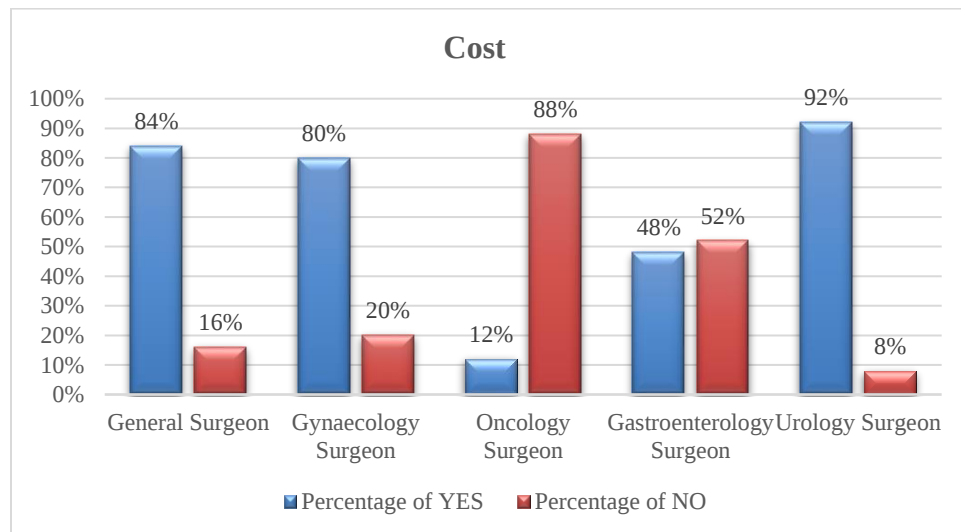
- Smart Tissue Sensing Technology:



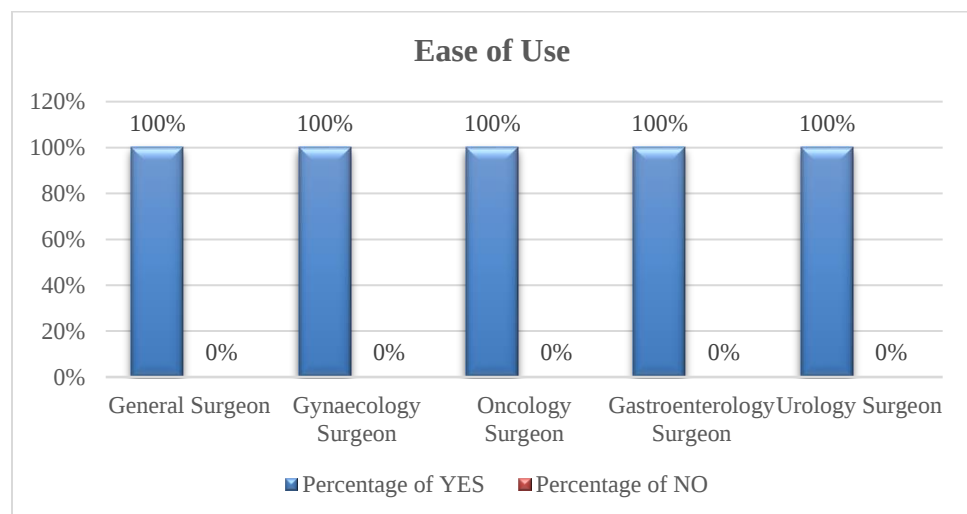
This Graphs Represents the ESU Technicalities Like Power Efficiency Ratio and Smart Tissue Sensing Technology Among the Surgeons by Taking a Sample Size of 25 Surgeons of Each Different Specialty and Their Responses are Recorded in Terms of Percentage

4. Factor Influencing the Choice of ESU Among Surgeons of Different Specialty.

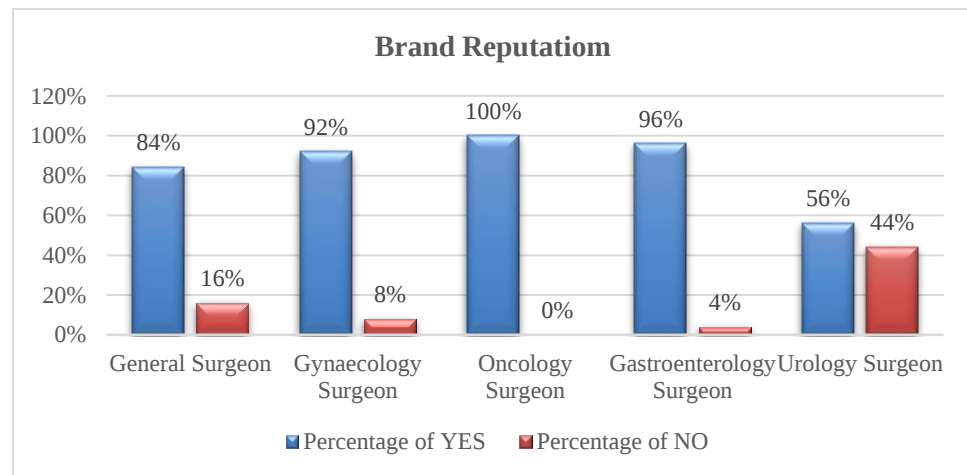
➤ Cost:



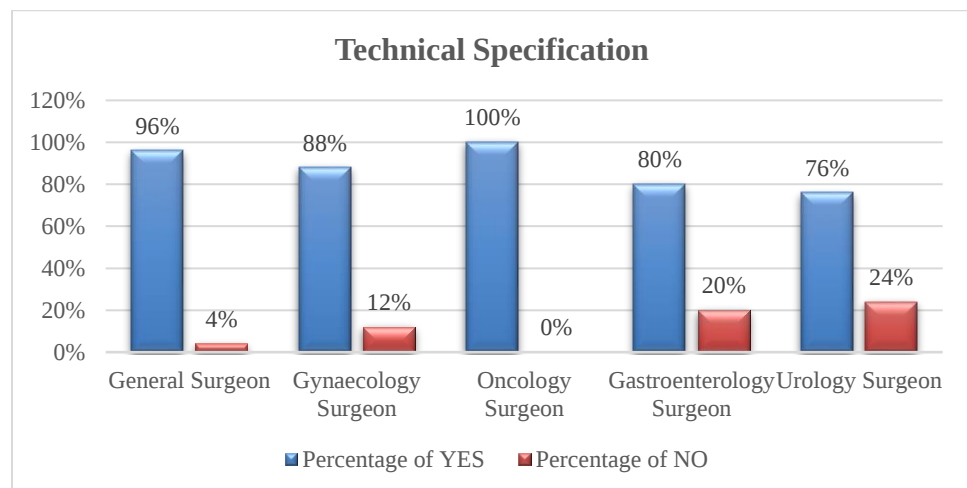
➤ Ease of Use:



➤ **Brand Reputation:**



➤ **Technical Specification:**



This Graphs Represents the Factors Influences the Choice of ESU Among the Surgeons by Taking a Sample Size of 25 Surgeons of Each Different Specialty Which Includes Factors Such as Cost, Ease of Use, Brand Reputation, Technical Specification and Their Responses are Recorded in Terms of Percentage,

CONCLUSION

When we Observe the Graph and Response of the Surgeons of Different Specialty one by one, talking on the Each Specialty Response When We Take the Surgeons Satisfied and Unsatisfied with Performance of Indian ESU Almost Majority Each Specialty Surgeon are Satisfied Except Oncology Because the General, Gynae, Gastro, Uro All Surgery Goes with Monopolar and Bipolar Hand Instrument and Bipolar Shearer for Achieving Cut and Coagulation Effect on Tissue.

But In case of Oncology Procedures This Segment Involves Complex Surgery Procedures So Oncology Surgeons Always Prefer High End Machine like Ultrasonic Range for Surgeries. Rest All Specialty will Goes with Normal Monopolar and Bipolar Diathermy Machines.

The Features Like PER, STST Plays an Important Role for Providing Accurate Surgical Outcomes by Delivering Precise Energy Delivery by Reading the Tissue Impedance and Providing Energy Delivery According to the Tissue Size.

The Market Players Has Though the Surgeons, Surgical Outcomes Achieved by only by High Power Settings and Market Players Played only on the Cost Basis Keeping the Important Features and Technicalities That has to Thought and Educated to Surgeons. By the Graph Analysis we can Clearly Observe the Knowledge Gap on ESU Among the Surgeons.

Like PER, STST and PRE - CQM Features Allows to do Surgical Procedure at Very Low Power Settings Which Helps to Get Desired Tissue Effect Faster Patient Recovery and Better Surgical Outcomes.

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