JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A Review Paper On Portable Electrocautery Machine

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Abstract : Electrocautery is the use of high flexible polarity, electrical energy in biological tissues as a means of cutting and coagulate tissue. Its advantages include direct cutting force with moderate blood loss. Electrocautery devices are frequently used during surgery that help prevent bleeding in the operating room at the hospital. Nowadays, Electrocautery devices are available via cable connection. Wire technology has a number of visible limitations wireless input technology. Lack of mobility, risk of injury, and embarrassment are all problems with the use of cable technology. The ultimate goal is to convert this technology into a single-hand drive powered by a rechargeable battery.

Index Terms **- Electrocautery**

I. INTRODUCTION

In 1910, William Clark, on a small scale, observed that the tissues suffer from this decrease due to fatigue. In 1914, he used the word citation [2]. Bovie created a diathermy unit that currently produced a high frequency introduced with a "cutting loop" that would be used for cutting and tightening. The first use of his tools in the Boston workshop. Increased awareness of the latest surgical techniques in developing regions is expected to ensure the rapid growth of the global market. There are two types of electrosurgery namely Monopolar electrosurgery and Bipolar electrosurgery [9].

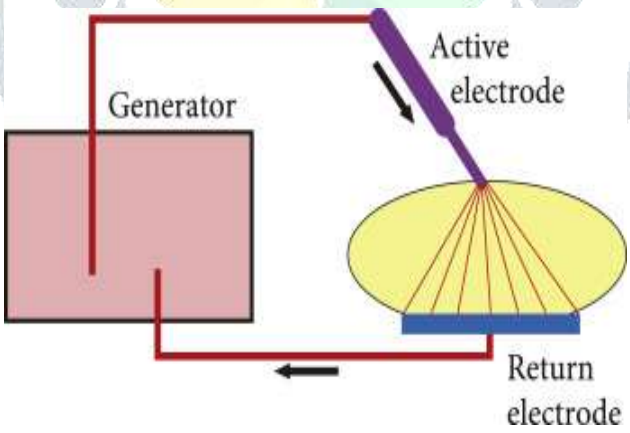

Fig 1: Monopolaar electrosurgery[9]

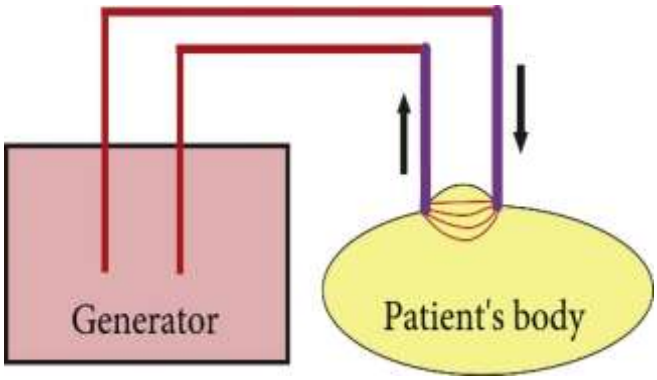

Fig 2: Bipolar electrosurgery[9]

In modern days, uses of electrosurgical equipment's are gradually increases in hospitals. Nowadays, Electrocautery devices are available with wired connections. Wired technology has several notable limitations. Wires are a common source of surgical complications, including, mobility, cable breakage and electrical noise.

Table 1 is giving an overview of the tissue effects of the two traditional and two innovative energy modalities.
In monopolar electrocautery electrodes, radiofrequency current flows from the generator through the active electrode, into the target tissue, through the patient, the dispersive electrode and then returns to the generator [11].

	Monopolar	Traditional Bipolar	Advanced Bipolar	Ultrasonic
Tissue Effect	Cutting, Coagulation	Coagulation	Cutting, coagulation	Cutting, coagulation
Power Setting	50–80 W	30–50W	DEFAULT	55,000 Hz frequency
Thermal Spread	Not well assessed	2–6mm	1–4mm	1–4mm
Maximum Temperature	>100°C	>100°C	Not well assessed	<80°C
Vessel Sealing Ability	Not applicable	Not applicable	Seals vessels ≤7mm	Seals vessels ≤5mm
Technique	Not applicable	Not applicable	Tension free application	Tension free application

Table 1: Comparison of Tissue Effects of four different Energy Modalities [11]

Excessive hair, adipose tissue, bony prominences, and the presence of fluid and scar tissue compromise the quality of contact. To avoid this type of injury, contact quality monitoring systems were introduced in 1981. This system inactivates the generator if a condition develops at the patient return electrode site that could result in a burn (Table 1). In bipolar electrocautery the active and return electrodes are located at the site of surgery, typically within the instrument tip. The classical example is the 2 tines of forceps that are the active and return electrode and represent the entire circuit. Most bipolar units use a lower voltage waveform to achieve hemostasis and avoid collateral tissue damage [11].

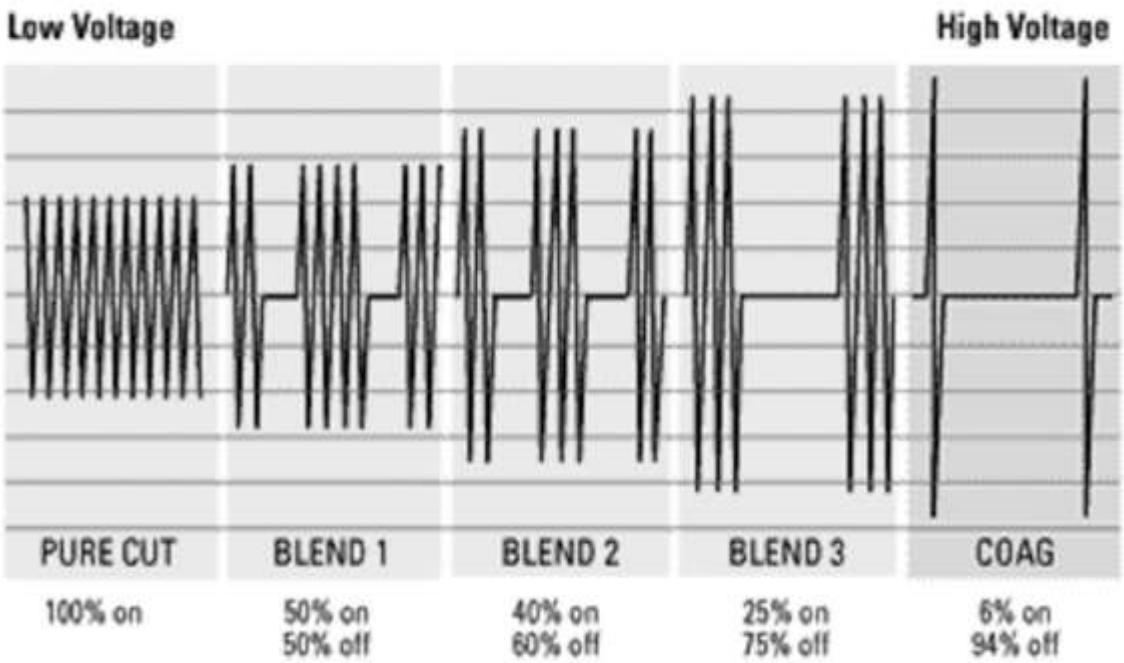

Fig 3: Different waveforms of eleectrosurgery/electrocautery [11]

Electrosurgical units pro- duce 3 different waveforms: cut, blend, and coagulation (Figure 2). A pure cutting (vaporization) waveform is continuous, unmodulated, and undamped. A coagulation waveform is interrupted, modulated, and damped current. A blend waveform is a modification of the cutting waveform and is used when hemostasis is needed while cutting. This waveform type consists of a combination of both cutting and coagulation waveforms. Higher blend settings trans- late into more time between bursts of current and greater coagulation, as seen in the following examples: Blend 1 (80% cut, 20% coagulation); Blend 2 (60% cut, 40% coagulation); and Blend 3 (50% cut, 50% coagulation) [11].

II. Electrocautery/Electrosurgery

Electrosurgery generator (ESU) units are an integral part of operational resources and are the most useful and common tools used by surgeons today. Electrosurgery generators generate highly variable power (AC) and are different in electrical units because both the cutting and coagulation effects can be achieved with a single device. Electrosurgery, also known as surgical diathermy, was first developed by William Bovie in 1926, and is a therapeutic technique that involves the production of electromagnetic heat by passing AC frequencies through normal biological tissue [2]. This method allows for high frequency cutting or contraction of tissues, reducing blood loss and reducing operating hours.

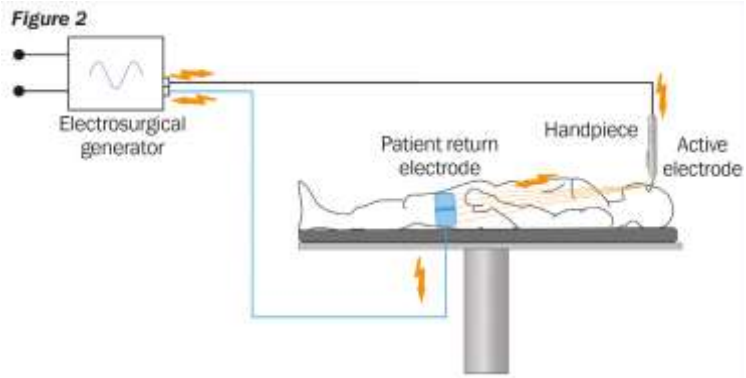

Fig 4: Generalized diagram of Electrosurgery[3]

Electrosurgical equipment is widely used in radio frequency (RF) frequency of 200 kHz to 5 MHz. Electrosurgical devices are often used during surgery that helps prevent blood loss in hospital operating rooms or surgical procedures. High-frequency waves, in addition to their practical application, can also be used in operating theaters for surgical purposes that include cutting and coagulation.

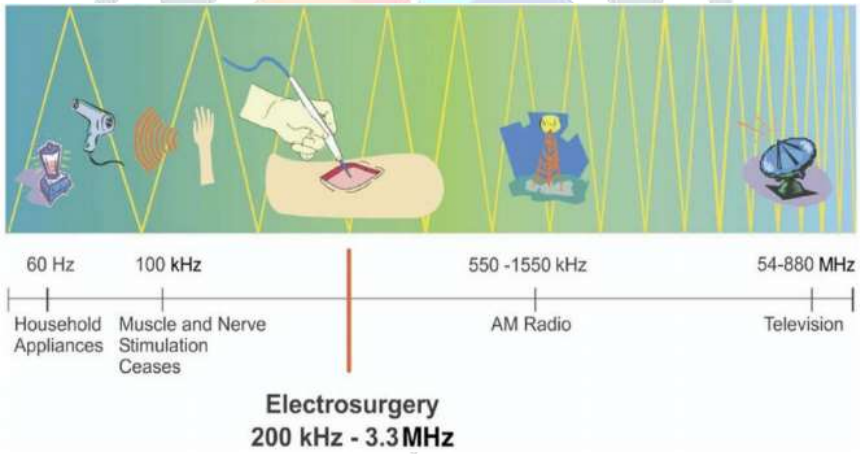

Fig 5: Frequency range of Electrosurgery[1]

III. Survey of literature review

In 2019, Dr. Ahilasamy Nagalingeswaran invented an In this invention, instrument is made of stainless steel 403 grade having circular knife jaw which is of 2 mm and characterized in that, black color silicon shrinkable sheet protected on it. The advantage of this is it cause minimal bleeding so endoscopic ear surgery done by single hand becomes easier.[7]

In 2018, Ali Idham Alzaidi at el. used DC-DC Flyback converter power supply with single phase inverter to taking advantage of Insulated-Gated Bipolar Transistor (IGBT) devices in order to improve performance and a high power density implementation. The advantage of this is converter generate useful waveforms required by the application with controlling voltage as per requirements. The disadvantage of this is they implement proposed method on virtual platform.[4]

In 2017, Ali Idham Alzaidi at el. used Pulse Width Modulator (PWM) for reducing power delivered by electrical signal, Transmitter for transmit charge and receiver receive charge and generate higher amount of thermal heat at the end of electrode. The advantage of this is more secure for medicinal inserts – For installed restorative gadgets, permits driving through the skin instead of having wires penetrate the skin, which would expose too many germs and diseases. The disadvantage of this is slower charging and more costly because of inductive charging.[5]

In 2017, Smitshoekseweg 195 developed the forceps jaws and tube form at least two bipolar electrodes for providing a bipolar diathermy at a distal end of the forceps jaws and tube. An elongated element extends through the tube and is movable with respect to the tube and comprises at least one electrically conducting core, where the forceps jaws are fixed to the elongated element, and the at least one electrically conducting core is electrically connected to one of the forceps jaws. The advantage of this is it having a diameter of at most 1 millimetre. The disadvantage of this is forcep comprising of wired connection which sometimes not comfortable.[6]

In 2016, Fred E. Baron and Alexandr Reznik used cylindrical housing which surrounds one or more batteries. Typically, a metal-wire tip is in electrical communication with the batteries. A switch is used to selectively apply electrical current to and heat the metal-wire tip, the heated tip can reach very high temperatures. The advantage of this is device is small and compact. The disadvantage of this cauteries are often disposable and it is designed for a single use.[8]

IV. CONCLUSION

Proper use of electrosurgery allows the surgeon to perform various procedures safely and selectively, with minimal damage to unwanted tissue. Comorbid conditions such as cirrhosis of the liver, chronic steroid use, athero- sclerosis, malnutrition, diabetes, collagen vascular turmoil, systemic contamination, etc. may indicate differences in body tissue, composition, and morphology that may alter or suppressed the strength and function of the bipolar gadget [10]. With this work I successfully developed an electrocautery cutting device. The main features of electrocautery produce an arc at the end of the electrode needle and cut the tissue with a high voltage generator. There are various types of electrocautery controls mentioned, but the main thing is to improve the portable electrocautery generator using a rechargeable battery.

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