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AGNIKARMA (CAUTERY) A PARASURGICAL PROCEDURE - NEW INNOVATIONS

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ABSTRACT

"*Agnitapten shastren chhindyat anyatha pakbhayam syaat"* (Incision should be taken with heated or sterlized instrument otherwise suppuration can occur). this Narration from *dalhan tika* and "*Daaha sankochayet Sirah*"(heat constricts or close the vessels) by Acharya Sushruta is self-explanatory about the value of *Agni* (Thermal Energy) in Surgical field. In *Sushruta Sutrasthana Agnikarmavidhi adhyaya*, Sushruta has described each and every aspect of Thermal Cauterization. According to him cauterization is the ultimate Source to treat the disease which could not be cured with the help of medicines, surgery and chemical cautery. Ailments treated with thermal cautery do not recur thus establishing the supremacy of *Agni karma* (cauterization) in curing diseases. This process of Cauterization was very well known and in use in the Sushruta era as described above, over the centuries it slowly vanished due to ignorance and orthodox beliefs. Now, this modality of treatment is emerging again with new researches and advancements proving its efficacy in pain management, coagulation, cutting the tissues etc. and it is part of day to day surgical procedures including radio ablation of fissure to laparoscopic surgical cauterization and use of argon beam laser. Thus, *Agnikarma*(Thermal cauterization) Procedure is now accepted worldwide in new form with new innovations.

AIMS AND OBJECTIVE

Aim

1) To elaborate the changes in *Agnikarma* (Thermal cauterization) therapy over the period of time.

Objective

1) To assess the new innovations in the field of *Agnikarma* (Thermal cauterization).
2) To compare the new advancements with the basics of *Agnikarma* (Thermal cauterization).

Methodology: Information regarding *Agnikarma* (Thermal cauterization) and New Advancements in the field will be collected from Samhitas, literatures, websites etc. Each information will be evaluated and collected having basics of *Agnikarma* (Thermal cauterization) and described in this Paper.

Conclusion: Many Changes and innovations have been made in *Agnikarma* Therapy with New Technical Advancement, but the basic Principle remains the same as told by Acharya Sushruta. As Acharya Sushruta told that Diseases treated by *Agni karma* (Thermal Cautery) never reoccur. We Should adopt the new techniques with newer innovations which is need of time and try to apply it with keeping basic principles in mind to treat the diseases and serve the Mankind.

KEYWORDS: *Agni karma*, Cauterization, Coagulation, Laser, MASER, Argon plasma coagulator.

INTRODUCTION

Agni karma, also referred as *Dahana-karma* or *dagdha-karma* (cauterization) is a procedure in which we supply energy in the form of heat to the specific tissue or part of the body. according to dalhana, *Agni karma* can be classified as

"*Agni krita karma"* - The karma or action carried out by *Agni.*

"Agni Sambandhit karma" - The karma or Actions Related to *Agni.*

"Agni karmaadhikrit karma" - The karma which are done under heading of *Agni*.[1]

On Exploring the Historical Background of *Agnikarma* we find that the roots of this treatment emerge from *Vedic* era. For example-in *Rigaveda* Application of *Agni* (fire) is indicated in treatment of different gynecological and obstetrical disorders. according to Rigveda *Agni* (fire) can destroy the invading parasites in the uterus of the woman. In Yajurveda *Agnikarma* is indicated in sheeta and sheeta induced diseases. Samaveda has elaborated *Agni* (fire) in separate chapter as 'Agneya kanda' giving *Agni* names as *Parmeshwar* (God), *Aatma* (soul),

Vaishwanar (fire) etc. In Atharvaveda *Agni* called as 'Rakshoha Agni'(Saviour fire) used to protect the body from micro-organisms. Nowadays sterilization by heating process has same base derived from our *vedic* knowledge.

In Samhitas Agni is considered as the root of life. Equilibrium condition of Agni helps in maintainance of health, *Bala* (Power), *Varna*(colour), *Oza* (form of energy), *Utsaha* (energy), *Prabha* (light) and metabolism whereas vitiation of the same produce *Roga* (disease) and destruction of Agni is responsible for death of diseased.

Agnikarma (cauterization) is a therapeutic modality where the energy is applied to cure various ailments. The application of energy is carried out with the help of different agents in different diseases at various sites considering the state of physical norms of the sufferer and the clinical condition.

Acharya Sushruta in *Sushruta Samhita* has vividly described various aspects of this treatment modality. The term *Agnikarma* is defined as the therapeutic action carried out by or by the mediation of *Agni* or thermal energy. Sushruta put the *Agnikarma* as supreme of all Para surgical processes and explained it in detailed manner.

The reason behind this Supremacy of *Agnikarma* as told by Sushruta is because the wound created by *Agnikarma* is free from pathogens, so if proper post-procedure care taken the wound heals without infection and suppuration. another advantage is that after *Agnikarma* contraction of small vessels takes place so there is no or very less bleeding which helps in bloodless procedure and wound heals quickly.[2]

Classical Review

Classification of *Agnikarma*

Acharya Sushruta in *Agnikarmavidhi adhyaya* has described the procedure, do's and dont's in detail. Though classification of the *Agnikarma* is not clearly described, we can classify it according to its application.

According to site

Sthanik (local) – as in *arsha*(haemorrhoids), kadar(corn) and vicharchika(psoriasis).

Sthanantariya (distal to site of disease) – as in gridhrasi (sciatica) and *apachi* (Multiple Goiter).

***Dahanopakaran* (Amount of Heat Transfer)**

Acharya described the various instruments (*dahanopakarana*) for *Agnikarma*. Through these instruments Amount of heat is transferred to tissue in different amount.

They can be classified as

Herbal *Upkarana* - *pippali*, *madhu*(Honey), *guda* (jaggery), *ghrita* (melted butter), *tailam*(oil).

Upakarana of Animal origin - *godanta*, *ajashkrut*, *madhuchhista*.

Metalik *Upakarana* – shalaka of gold, silver, copper, *loha* (iron).

Others - *shara*, *jambavoshtha*.

Other acharya described *majja* (bone marrow) *varti*, *Suryakant*, *ardhenduvakra shalaka* (type of rod) *kolasthidal shalaka* and *nadi yantra* also can be used as *dahanopakarana*.[3]

According to dravya

Snigdha Agnikarma (wet cauterization) - dravya like *madhu*, *ghrita*, *tailam* used to treat *sira* (veins), *snayu* (nerve), *sandhi* (joints), *asthigat roga* (diseases).

Ruksha Agnikarma (dry cauterization) - *dravya* like *pippali*, *godanta*, *shara*, *shalaka* etc. used to treat *twak* (skin) and *mamsagat* (muscular) roga(disease).[4]

According to *akriti* (shape) – These provide different Area of Contact.

1. **Valaya** - circular in shape.
2. **Bindu** – dot like.
3. **Vilekha** – linear it may be straight, oblique or zig zag.
4. **Pratisarana** – Dragging the shalaka over diseased part.[5]

According to Ashtang hridaya there are 3 more types of *Aakriti* (shape) –

5. **Ardhachandra –** crescent shape
6. **Swastik –** specific shape of swastika yantra
7. **Ashtapada –** shape of eight limbs.

According to *dhatus* affected

- *Twak dagdha* (burn upto skin)
- *Mamsa dagdha* (burn upto muscle)
- *Sira snayu dagdha* (burn upto veins and nerves)
- *Sandhi asthi dagdha* (burn upto joints and bone)

According to site of use

Superficial diseases – *Pippali, Ajashakrut, Godanta, Shara Shalaka* are used in diseases of skin.

Muscular diseases – *Jambavoshtha* and various metals used for muscular diseases.

Sira snayu sandhi asthigat diseases – *Kshaudra* (honey), *Guda* (jaggery), and *Sneha* (butter) is used in vessels, joints and bony ailments.[6]

Modern era development

Locally, supply of heat to the tissue stimulates histamine, prostaglandin and bradykinin release that relaxes vascular smooth muscle and contributes to vasodilatation.

At spinal level, due to afferent thermo receptor stimulation, decreased sympathetic tone results and further relaxes vascular muscle tone. Sufficiently warmed blood reaches the thermoregulatory hypothalamus and causes increased metabolism and perspiration. At tissue level local heating results in decreased viscosity and increased tissue elasticity. To understand the effect of heating they can be categorized into two groups.

1) Direct 2) Indirect

Multiple factors determining the extent of the physiologic response to heat, include the following

- Level of the tissue temperature (usually 40-45^{0}c)
- Duration of the tissue temperature increase
- Rate of tissue temperature rise.
- Size of the area being treated

Table Showing Superficial and Deep Heat Therapy Subtypes.

Superficial Heat Therapy	Deep Heat Therapy
➢ Heating pad	➢ Quantum therapy
➢ Hot packs	➢ Transcutaneous electrical stimulation (TENS)
➢ Heating lamps	➢ Interferential Therapy
➢ Hot water bag	➢ Radiation Therapy - Infrared therapy - Diathermy - MASER - PMF
➢ Paraffin wax	➢ Electro cautery
➢ Hot needling	➢ Argon Plasma Coagulator

We are considered More with Heat therapy where *Agni* (fire) is involved directly. so we will consider more the Procedures where Heat is Produced by direct Action of *Agni* (fire).

Deep Heat Therapy

❖ **Radiation Therapy**

- Infrared Therapy

Infrared Rays are electromagnetic rays with wavelength of 750nm – 400000 nm.

Any hot body can emit infrared rays for eg. sun, wood fire, coal fire, electric fire etc.

There are two types of generators for therapeutic application.

Non luminous generator - Used for acute and recent type of lesions.

Luminous generator – Used for chronic type of lesions.

Application

At the Commencement of the exposure the intensity of radiation should be kept low. After vasodilatation when blood flow increased, the strength of radiation may be adjusted. If radiation is extensive, sweating may occur to counteract the under rise of temperature. The spin should be red at the end of exposure. patient should not rise suddenly from the recumbent position or go out into cold immediately following radiation.

❖ **Diathermy**

Effects-

1) It produces Area of Electric field, which increases blood supply.
2) Increases blood circulation in deeper structures like muscle.
3) Rise of temperature in deeper structure/joints.
4) Microwaves are strongly absorbed by water, so there is appreciable heating of tissues with good blood supply such as muscle but less heat is produced in those with low fluid content such as fat.

Ultrasound diathermy

Ultrasound is mode of deep heat in common use. ultrasound penetrates a depth of 1-5 cm depending on the frequency used.

Short wave diathermy

Short wave Diathermy current has a frequency of 27.12 megahertz (MHz) and wavelength of 11 cm.

Microwave diathermy

Microwave diathermy is an irradiation of tissue with energy of electromagnetic waves i.e. microwaves (wavelength of 1-100cm). But therapeutically the radiation with wavelength of 12.25 cm and a frequency of 2450 MHz is frequently used and also some use of radiation is made with a wavelength of 6900 and frequency of 433.92 MHz.

❖ **Laser Therapy**

LASER Stands for light Amplification by stimulated emission of Radiation. it is a form of Phototherapy which involves the Application of monochromatic light over biological tissue to elicit a bio modulative effect within that tissue. The lower power LASER radiation is Used in physiotherapy whereas higher power LASER radiation is Used in various Surgeries for tissue cutting.

Therapeutic effects of LASER (*Agnikarma*)

- Analgesic
- Anti-exudative
- Anti-hemorrhagic
- Anti-inflammatory
- Anti-spasmodic
- Anti-neuralgic
- Antiseptic
- Anti-edematous
- Vasodilatation.

❖ **Maser Therapy**

The term MASER Stands for light amplification by Stimulated emission of Radiation. As the Name Suggests Maser produce and amplifies electro-magnetic radiation in the microwave region of the Spectrum.

The Objective behind using the MASER on a diseased tissue or diseased organism, in situ, is at the characteristic resonant frequency of those tissue and organism, it destroys them selectively leaving behind healthy tissues undamaged.

❖ **PMF Therapy**

PMF therapy means Pulsating Magnetic Field Therapy. Magnetio-biology is new frontier Science where the Magnetic force of physics interacts with the biological elements in living tissues.

The PMF therapy can be used in the treatment of pain of musculoskeletal origin, R.A, Osteoarthritis and lumbar or Cervical spondylosis.[7]

❖ **Electrotherapy or Electrocautery**

Therapy with modified electric current is called Electrotherapy, here electric current or electric stimulation is used for therapeutic purposes.

Types

The therapeutic current used are divided into the following types on the basis of frequency used, which are.

1) High frequency current used for its diathermy or heating effects.
2) Low frequency current used for stimulation of nerve or muscle.

This electric current produce rise in temperature of the tissue. Here heat produced is same as that produced in process of *Agnikarma* so mechanism of electrocautery resembles the process of *Agnikarma* as illustrated in Ayurveda.

Electric stimulation

Current which varies significantly in mAgnitude can stimulate a motor nerve, which produces contraction of the muscle to which it is supplied. While in absence of a motor nerve, the muscle fibers can be stimulated directly by a suitable current. Intermittent current is used in both cases (in nerves and muscle fibers).

Types of electric stimulation

Electric Stimulation can be given in two ways-

1) Faradic current – useful in stimulation of muscle with intact nerve supply.
2) Galvanic current – which is best type of stimulation of a denervated and paralyzed muscles. This produces contraction and maintains the muscle tone in good form and prevents atrophy.

❖ **Cauterization**

Scarring or burning the skin or tissues by means of direct application of the physical agents particularly heat or the caustic chemicals used for therapeutic purposes is called cauterization. In this procedure an electric cautery consist of platinum wire loop or point is used which is heated to red hot by means of an electric current. This heated cautery point is then applied to the area to cause coagulation.

Types

a) Galvano cautery
b) Monopolar cautery
c) Bipolar cautery
d) Diathermy
e) Thermo cautery
f) Chemical cautery
g) Others including Paquelin's thermo cautery[8], button cautery, potential cautery, steam cautery, cold cautery.[9]

Nowadays most commonly used electro surgical instruments are discussed below.

1. Monopolar Cautery

In this pencil instrument is used, the Active electrode is placed in the entry site and can be used to cut tissue and coagulate bleeding.

The return electrode pad is attached to the patient, so the electrical current flows from the generator to the target tissue through the electrode and return back going through the electrode pad to the generator.

Monopolar electro surgery can be used for several modalities including-

1. Cut,
2. Blend,
3. desiccation,
4. fulguration.

Advantages of Monopolar Instruments

1. Multiple modalities
2. Adjust current Density

3. Inexpensive
4. Easy to use
5. Easily Available
6. Best method for bloodless incision on the skin.

Disadvantages of Monopolar Instruments

1. Interference with pacemakers and other equipment during surgery.
2. Produces higher temperature and relatively longer cool down period.
3. Large thermal Spread.

2. Bipolar cautery

In this cautery electrons flow between two adjacent electrodes. The tissue between the two electrode is Heated and desiccated.

With bipolar cautery chance of cutting is less so this is best for coagulation of small vessels without thermal injury.

Bipolar electro surgery uses lower voltage and less energy. as this has limited ability to cut and coagulate large bleeding areas, it is more ideally used for those procedures where tissue can be easily grabbed on both sides by the forceps electrode.

Advantages of Bipolar instruments

1. Better control over the Area being targeted and helps prevent damage to other sensitive tissues.
2. The risk of Patient burn is reduced Significantly.
3. Can be used in patient with implanted devices to prevent electrical current passing through the device causing a short- circuit or misfire.
4. Good for vessel sealing.

Disadvantages of Bipolar cautery

1. Operational time is usually longer than Monopolar electrosurgery.
2. Not as effective on smaller vessels as monopolar.

According to AORN journal (AORN-Association of perioperative registered Nurses)

- Around 40,000 pts. burned by faulty Electro-Surgical Unit every year.
- 70% of them are undiagnosed at the time of Surgery.[10]

❖ **Ultrasonic Energy System-**

- Infrasonic waves having frequency less than 20 Hz
- Audible waves having frequency ranging 20-20,000 Hz
- Ultrasonic Waves have frequency more than 20,000 Hz.

Ultrasonic generator has minimum setup around 50 micron i.e. level 1 and maximum setup at 100 micron i.e. level 5.

Minimum setup or level 1 is used for coagulation purpose and maximum setup or level 5 is used for Cutting the vessels.

Tissue effects

- Cutting
- Coagulation
- Cavitation
- Drilling

Advantages of Ultrasonic Energy System (Harmonic Scalpel, ESWL etc)

- Produces less heat compared to other Sources (less than 80 degrees to 100 degrees Celsius for electro surgery) thereby reducing the risk of thermal injury.
- Does not transmit active current in the tissue and thereby eliminate any risk of electric Shock.

Disadvantage of Ultrasonic Energy System (Harmonic Scalpel, ESWL etc.)

- Slower coagulation compared to electro surgery
- Not as efficient in sealing medium to large sized blood vessels. Not reliable in Sealing vessels larger than 3mm.
- Produces high blade temperatures and can damage adjacent tissues or organs when come in contact immediately after Switched off.

❖ **Argon Plasma Coagulator**

The concept of laser was first described in Einstein's published papers on quantum theory in 1917. In 1960 maiman developed the first laser device. From 1928 to 1970, Surgeons have widely used high-frequency electrosurgery for hemostasis, coagulation and tissue cutting. Afterwards fiber-optic flexible endoscopes were developed to visualize the esophagus,

stomach, duodenum and colon. after invention of flexible electrical devices with flexible endoscope Endoscopic electrosurgery became possible. The 3 modes of high frequency coagulation are monopolar, bipolar and fulguration. Today, Monopolar and Bipolar are the two primary modes of high frequency energy used.

Plasma Technology – The application of plasma technology is seen in Televisions, lighting etc. Matter can be grouped as Solid, liquid, gaseous or plasma states. gradual increase in temperature causes ice (solid state) to liquify into water (liquid state), water into steam (gaseous state) and steam into plasma (plasma state). when additional energy is supplied to the gas electrical conduction occurs, despite the preservation of electrical neutrality. this process occurs when the electrons gain sufficient energy to separate from the atoms or molecules of the gas. Plasma is a collection of electrically charged particles such as electrons and non-charged particles such as radicals (a type of chemically reactive atom or molecule). Plasmas are functionally different if they are in thermal equilibrium as opposed to non-equilibrium states. Thermal equilibrium plasmas are typically present in stars in contrast to non-equilibrium plasmas. low temperature plasmas (cold plasma) are useful in our day to day life; this technology is evolving and being used in modern material science, nano-technology, microelectronics and semiconductor technology. Cold Plasma technology has remarkable biomedical applications. Cold Plasma technology is believed to replace conventional modes of medical treatment in medicine and surgery.

The APC is based on the use of a beam of high purity (99.99%) ionized argon gas to conduct the current to the tissue. A stream of argon is colorless, odorless, inert(inactive) gas that conducts the current to the tissue and vessel walls. Argon is a noble, inert gas that will not react with other elements. It is one of the safest gases known.it will not support combustion and it clears the body in one respiratory cycle. The APC functions in a non-contact manner.

The APC, form of cold plasma technology has been shown to be effective in coagulation of blood vessels and human tissue during surgery. APC technology is superior to conventional modes of electrosurgery (Radio Frequency) because tissue destruction is greatly reduced.

APC probe has a flexible wire having a nozzle tip with an opening through which argon gas flows. it includes a handle for placing the tip in position for tissue coagulation. Within the tip is located a tungsten needle for discharging radio frequency (RF) current which ionizes the Argon gas.

The electrical current is initiated only when the tip of the hand piece or catheter is within 1 cm. of the target tissue. A more homogenous 1 to 2 mm well delineated scar is produced by the APC which is more effective than standard electrocautery because it disturbs the arc tunnels in a more even pattern and more uniform depth. The eschar remains firmly attached to the tissue, in contrast to other modalities of coagulation where there is an overlying charred layer of coagulated blood. Argon is used in this system because it will not oxidize the electrode. The temperature in the tissue being cauterized never exceeds 110^0 because of the cooling effect of argon gas and because no further conduction of radio frequency energy into tissue occurs once an eschar form. Use of APC is thought to minimize tissue destruction and necrosis.

In contrast to the APC, electrosurgery and lasers use electrical energy to localize heat and thereby achieve hemostasis. With temperature dependent mechanisms such as electrocautery, tissue temperature increases to 200^0, causing the heating of cellular water to boiling and the subsequent rupture of cell membranes and the photo evaporation of tissue. With lasers, tissue temperature rises even higher to 300^0 to 400^0 at which point carbonization occurs and then to 500^0 when combustion occurs. This heat is distributed in an uneven fashion and may lead to the damage of adjacent tissue and an unknown depth of tissue injury.[11]

DISCUSSION

As per ancient records in Ayurveda, treatment by transferring heat direct or Indirect form was well known and practiced as early as 1000 years BC. It was followed till late 19^{th} century. Introduction of electricity in the medical field and anaesthetic advancements opened the door of new techniques in the field of *Agnikarma* (cauterization) for hemostasis, coagulation and cutting purpose.

According to Ayurvedic Principles *Vataja* and *Kaphaja* diseases can be treated with *Agnikarma* as *Agni* has *Ushna guna* (hotness property) which is opposite to *Sheeta guna* (coldness property) of *vata* and *kapha*. *Agni* plays and important role in maintenance of health, equilibrium and vitality of body. Every Dhatu or tissues has its own thermal equilibrium *(DhatvAgni)*. when this *DhatvAgni* (thermal equilibrium) becomes low, diseases begin to manifest. *Agnikarma* (cauterization) works by giving external heat to the tissue thus maintaining its thermal equilibrium which helps to pacify aggravated *doshas* resulting in normal functioning of the tissue or the body part and hence alleviate the disease.

All pain management equipment mainly use heat energy in some or other form as a basic principle. For example, therapeutic ultrasound is most traditionally known as a deep heating modality. It yields its effect by increased collagen extensibility, increased clearance of edema and exudates, increased pain threshold, decreased joint stiffness and decreased muscle spasm. all these are effects of deep heating system.

The main forms of Cauterization used today are electrocautery and Argon plasma coagulator. Electro cautery – electrosurgery has been described as high-Frequency electrical current passed through tissue to create a desired clinical effect. Electrocautery used in tissue and vessels hemostasis and in the treatment of various small benign skin lesions, although only lesions that do not require histological review should be treated with electrocautery. Harmonic scalpel and argon plasma coagulators are the backbone of laparoscopic surgery and hemostasis respectively.

CONCLUSION

Agnikarma therapy, described and practiced by the Acharya Sushruta have been followed by the people worldwide for more than thousands of years. With the new innovations now, we have developed the new tools, techniques which run on electricity these tools are easy to handle, sophisticated to use, advanced according to need of present era with other advancements like laparoscopy and anesthesia but the Basic principle remain the same as that of *Agnikarma* i.e. transfer of Heat to the tissue for management of disease, hemostasis, cutting of tissue etc as told in Ayurvedic literature.

As Acharya Sushruta told that Diseases treated by *Agnikarma* (Thermal Cautery) never reoccur. We Should adopt the new techniques with newer innovations which is need of time and try to apply it with keeping basic principles in mind to treat the diseases and serve the Mankind.

REFERENCES

1. Vd.Yadavaji Trikamji, Sushruta Samhita Dalhana Tika sutrasthana-ch-12/1-2, Chaukhambha Surbharti Prakashan, Varanasi, 2018; 50.
2. Vd.Yadavaji Trikamji, Sushruta Samhita Dalhana Tika sutrasthana-ch-12/10, Chaukhambha Surbharti Prakashan, Varanasi, 2018; 52.
3. Vd. Yadavaji Trikamji, Sushruta Samhita Dalhana Tika sutrasthana-ch-12/4, Chaukhambha Surbharti Prakashan, Varanasi, 2018; 51.

4. Vd. Yadavaji Trikamji, Sushruta Samhita Dalhana Tika sutrasthana-ch-12/4, Chaukhambha Surbharti Prakashan, Varanasi, 2018; 51.
5. Vd. Yadavaji Trikamji, Sushruta Samhita Dalhana Tika sutrasthana-ch-12, Chaukhambha Surbharti Prakashan, Varanasi, 2018; 52.
6. Vd.Yadavaji Trikamji, Sushruta Samhita Dalhana Tika sutrasthana-ch-12/4, Chaukhambha Surbharti Prakashan, Varanasi, 2018; 51.
7. Vd. Megha tyagi, A pilot study of Agnikarma on frozen shoulder (Avabahuka), Rajiv Gandhi University of Health Sciences, Bangalore, Karnataka.
8. Website- https://en.m.wiktionary.org/wiki/Paquelin%27s_thermocautery.
9. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3755039/.
10. http://blog.boviemed.com/blog-1/bipolar-electrosurgery-vs.-monopolar-electrosurgery.
11. https://www.usmedinnovations.com/products-technology/history-of-plasma-electrosurgery/.