

Radiofrequency surgery in proctology

Its property to eliminate undue damage to the surrounding tissues has made radiofrequency surgery a popular method to treat various diseases

Dr. Pravin Gupta

THE use of electric currents in medicine had been documented almost since electricity itself was discovered. Low frequency alternating currents are used in physiotherapy for their ability to produce contractions in the muscle fibers for relief of pain and increasing muscle tone.

Radiofrequency is a refined type of electrosurgery that utilises a wave of electrons at a frequency between 2 and 4 MHz to incise, excise, ablate or coagulate the targeted tissue.

Radiofrequency surgery has a lengthy documented history of use in oral, ophthalmic, plastic and gynaecology surgery. It was first used for the treatment of snoring. Gradually, its use in the practice of dermatology, cosmetology, cardiology, neurosurgery, hepatology and ENT procedures gained momentum and popularity. It has multi-faceted usages in the respective medical fields. However, there have been few published reports of its use in the field of proctology.

Surgeons and proctologists have used this instrument very sparingly and that too more out of curiosity than a serious attempt to utilise its vast potentials. The reason perhaps, might be that they were satisfied with the results of the conventional techniques employed by them or were not sure about the use of this tool in the ano-rectal surgery for want of sufficient literature on



Figure 1: Radio Surgical Unit

the subject.

For a surgeon practicing proctology, there are few important goals to achieve. The aim of attempting a new technique should be at minimising tissue damage and obtaining an assured hemostasis during reconstruction, excision, or ablation process.

Radiosurgery-A New Face of Electrosurgery

Radiosurgery can simply be termed as an electrosurgery at radiofrequency. It is necessary here to dispel any possible misconception about radiosurgery by discussing two other, older modalities namely, 'electrocautery' and 'hyfrecation' that are quite different from radiosurgery.

Electrocautery involves the passage of low frequency, low voltage and low wattage alternating current (0.5-1.5 MHz) through the electrode, which resists the flow of current

and becomes hot. In electrocautery, the heat (rather than the radio wave) is transferred to the soft tissue by convection. A massive cell destruction results from the application of cautery and the destruction caused by this cauterisation is equivalent to that of a third degree burn.

While in hyfrecation, a well-modulated high frequency current of low wattage and high voltage is supplied to the electrode. The surface of the tissue is burnt by a spark, which is produced between the tip of the electrode and the tissue. Its effect is mainly superficial and cannot be used to incise the tissue.

The high frequency radiosurgery and its results should also not be confused with diathermy, electric cauterisation or spark producer. With radiofrequency, the targeted tissue temperatures stay localised within a range of 60-100° C, thus limiting heat



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dissipation and damage to adjacent tissue. In contrast, electrocautery, diathermy, or laser temperatures are significantly higher (750-900° C) that results in a very high heat propagation, which is far in excess of the desired therapeutic need. Electro surgical machines operating at frequencies below 3 MHz causes the electrode itself to heat and it has been found that these electrodes, if made of steel, tend to melt away with repeated use. It has been determined that the ideal frequency for achieving effortless cutting of tissues is approximately 4 MHz.

Radiofrequency energy has been used extensively in many different medical applications and specialties for its ability to achieve a precise and controlled thermal ablation of soft tissue.

The heat for this ablation is generated by a natural resistance of the tissue, which comes in the path of the waves released through the electrode tip of the device. The cellular water in the soft tissues gets heated and when the temperature reaches 100° C, it starts boiling and produces steam, which results in cellular molecular dissolution of individual tissue cells. The cells exposed to these waves are destroyed while the surrounding tissues remain unaffected. This property of radiofrequency eliminates the possibility of undue damage to the normal tissues, while improving the surgical precision.

The Radiofrequency Unit

An ideal radiofrequency unit



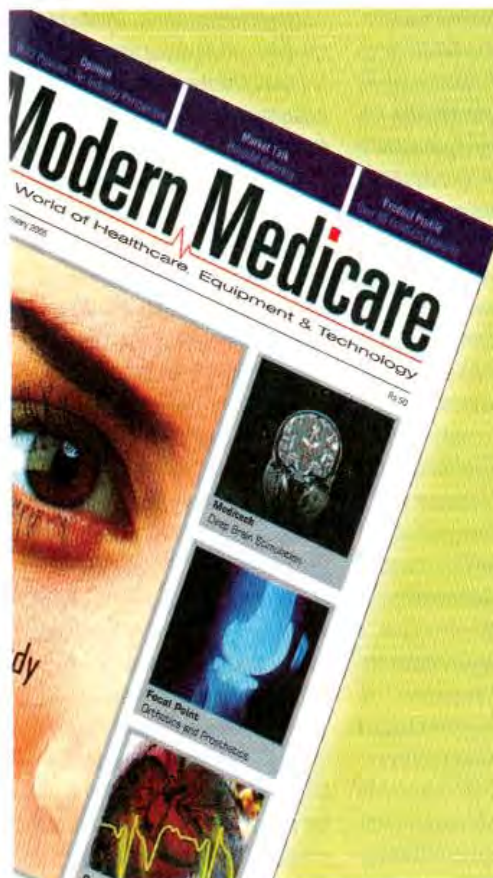
Figure 2- Hand piece and electrodes of the radiofrequency device

should be one which produces a frequency between 3.8 and 4 MHz and which is available with electrodes of different sizes and shapes to suit the requirement of the proctological procedure. The radiofrequency unit functions with the active electrode concentrating the high frequency energy at its tip and then transmitting it to the passive electrode, which returns

the waves to the unit, making them more effective.

Units producing frequencies above or below this range are not true radiofrequency units as the word 'radiofrequency' denotes a frequency used for radio broadcasting, which is between 3.8 and 4 MHz. (Fig.1)

The radiofrequency unit produces an output power of 100 Watts at two different



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frequencies i.e. 4 MHz and 1.7 MHz. While the frequency of 4 MHz is used for four standard settings like Cutting, Cutting and Coagulation, Pure coagulation and Fulguration, the frequency of 1.7 MHz is used for bipolar coagulation. The unit has a digital display and audible signal to indicate when the unit is activated. The output power intensity to be delivered through the electrode can be preset between 1 and 100.

The high frequency current of 4 MHz delivered by the unit is modified by filtering and rectification to produce one of the four waveforms, namely -

- Fully filtered- It is suitable for cutting and produces least lateral heat
- Fully rectified- It is suitable for cutting but also produces lateral heat to coagulate
- Partially rectified modulated-It is suitable for coagulation and generates maximum lateral heat
- Fulguration- It is a spark gap waveform used to produce dessication or dehydration
- Bipolar waveform (1.7 MHz) -

The property of simultaneous cutting and coagulation achieved by this machine is one of its most attractive features. Such versatility of the tool is of utmost utility in most procedures performed within the ano-rectal area, which is quite vascular and having very limited accessibility

This is primarily used in microsurgery and as hemostatic current of high precision in wet or dry areas, using a pair of tweezers as electrodes

An antenna is used to focus the 'radio wave', which unlike traditional electro surgical units, does not need to be in contact with the skin of the patient. It could rather be placed in close proximity of the operating field. The unit is activated by a foot pedal. The 'active' or patient electrode is interchangeable with four different modes of activities, which are the following:

- A Needle electrode, which is used for making incisions
- Loop electrodes, which are used for excision and shaping tissues
- Ball electrode, which is used for coagulation and
- Rod electrodes, which are used for fulguration and desiccation of the tissues (Fig. 2)

The property of simultaneous cutting and coagulation achieved by this machine is one of its most attractive features. Such versatility of the tool is of utmost utility in most procedures performed within the ano-rectal area, which is quite vascular and having very limited accessibility. While operating in such a difficult area, bleeding and oozing from the tissue often hampers clear vision of the operative field, rendering the procedure difficult and a time-consuming job. Radiofrequency surgical techniques successfully overcome these deficiencies.

Indications for Using Radiosurgery in Proctology

Radiofrequency surgery can

be used to tackle a variety of anal lesions. They include the following:

- Hypertrophied anal papillae
- External hemorrhoids
- Sentinel tags in anal fissures
- Perianal warts and condylomata
- Rectal polyps
- Fibrous anal polyps
- Perianal and pilonidal sinuses
- Post fissure antibiomas
- Perianal papillomas
- Biopsies
- Fistula in ano
- Hemorrhoids
- Rectal prolapse

Surgical Techniques

Most applications are accomplished with under local anaesthesia, short-term general anaesthesia or under a caudal block.

While many different electrodes are available with the unit, most of the procedures can be performed using the loop, the ball and the fine needle electrodes.

Hypertrophied Anal Papilla

They immediately disappear on coming in contact with the activated ball electrode in coagulation mode.

External Hemorrhoids

Small masses are coagulated with the ball electrode. However, a large sized mass is required to be shaved off with the round loop electrode kept in a cutting and coagulation mode. Any bleeders from the base could well be coagulated with the ball electrode.

Sentinel Piles in Fissure in Ano

Sentinel pile or tags are a common accompaniment of chronic anal fissures. If the tag is small, it could be directly coagulated with a ball electrode. In case it is large, then it is excised with the round loop

by first securing the bleeding points and coagulating them thereafter.

Perianal Warts and Condylomata

These could be shaved off using a loop electrode in cut and coagulation mode. Once all of them are removed, the operated area is 'sterilised' by rolling a ball electrode on coagulation mode to ensure removal of invisible warts and the viral colony. The intra-anal warts could preferably be coagulated rather than being excised.

Rectal Polyp

It is better if they are dealt with within the anal canal. A longer length ball electrode is passed through the proctoscope and a coagulation field is encircled around the base of the polyp. The pedicle is then coagulated until the mass is separated. This ensures a negligible bleeding which could be secured by coagulation with the help of the ball electrode in coagulation mode.

Fibrous anal polyps

These are forms of exaggerated anal papillae. These could be coagulated in-situ using the ball electrode, but when these are large enough, these may be shaved off with a loop electrode after coagulating the base.

Perianal and Para sacral Sinuses

These include the pilonidal sinuses, post anal sinuses and post-traumatic sinuses. Methylene blue dye mixed with hydrogen peroxide is injected in the sinus opening, which spreads out in the sinus tract. The tracts so identified, are then incised and laid open with the needle electrode. The bleeding points are secured by coagulating them with the ball

electrode. The wound is left open to heal by secondary intention.

Perianal Papillomas

These can precisely be removed using a loop electrode of a suitable size. The raw area left behind may require a touch of a ball electrode in coagulation mode to arrest any oozing from the base.

Perianal Antibiomias

These are also known as antibiotic granuloma, organised abscess, sterile abscess etc. The aim of treatment is to curette the complete cavity, which could be achieved by incising the center of the lump using a needle electrode in cut and coagulation mode. All the granulation tissues, which feel hard with little bleeding, are scrapped out with a round loop electrode until a soft red base is reached.

Biopsies

Biopsies can be performed for suspected growths in and out of the anus. A round loop electrode is the best tool. It should be used on a cutting mode, so that with only a minimum lateral thermal damage, the histology is not distorted.

Fistula in Ano

With a needle electrode on cut/coag mode, the fistula tract is slit opened over the director probe, which is inserted in the tract. The edges of the wound are shaved off by the loop electrode to create a pear shaped wound tapering towards the anus. The bleeding points are held in the hemostat and are coagulated.

Hemorrhoids

Radiofrequency surgery is useful in the treatment of both, early and advanced grades of hemorrhoids. The non-prolapsing internal

hemorrhoids could be directly coagulated in-situ with the ball electrode of a sufficient length under a surface anaesthesia as an office procedure.

The advanced and prolapsing hemorrhoids are first ablated with a ball electrode and then the ablated hemorrhoidal mass is plicated with absorbable sutures to ensure fixation of the anal cushions to the underlying structures. The results of this procedure are more assuring when compared with the conventional surgical techniques.

Rectal Prolapse

Radiofrequency has been used as an adjuvant therapy in elderly patients with rectal prolapse. A circumferential coagulation of the anoderm is made with the ball electrode and then a Thiersch's stitch is tied to encircle the anal verge. Radiofrequency coagulation induces fibrosis and create a zone of band around the anal verge, which helps in tightening the anal opening and preventing prolapse.

Almost all the above mentioned procedures are carried out as a day care surgery. Analgesics, antibiotics and stool softeners are prescribed according to the requirement. No specific wound care is found needed.

Complications

No major complications have been encountered with these procedures. Few minor ones to mention are...

- Deep dissection can cause more scarring and longer time for healing of the wounds.
- Excessive release of power produces more smoke and charring.
- Accidental burns either on the patient or on operator due to

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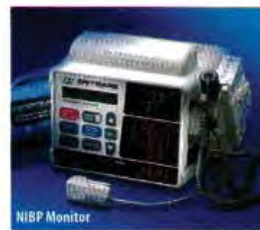
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Comparison with other conventional equipments used in ano-rectal procedures	
The other equipments used in the field of ano-rectal surgery include the Infrared coagulator, Cryo instruments, Lasers and Electrocautry. A brief account of their comparison with radiofrequency is as below.	
RADIOFREQUENCY Multiple applications/uses in proctology surgery Can cut, coagulate or fulgurate Low recurrence rate after treatment	INFRA RED COAGULATION Limited to coagulating bleeding internal hemorrhoids Can only coagulate High recurrence rate in hemorrhoids
RADIOFREQUENCY Simultaneous cut and coagulation Minimal smoke production Minimal surrounding tissue damage Heats tissues below 100° C Sterilises tissues under application Minimal scarring creates soft supple scar Faster healing	ELECTROCAUTERY OR BOVIE Requires different modes and adjustments for different applications Produces excessive smoke Tissue damage like 3 rd degree burns Raises tissue temperature above 500° C Can cause post-operative sepsis Gross scarring and fibrosis Slow healing
RADIOFREQUENCY Tissue interaction can be predetermined with power setting selection No tissue adherence or charring Minimal postoperative edema and discharge Result is immediately visible Multiple uses in proctology	CRYOSURGERY Difficult to achieve precise tissue destruction Probes often stick to the site of application and cause detachment of the tissue with bleeding Extensive edema and profuse discharge from the treated area Uncertainty of result due to variable tissue response Used for the treatment of hemorrhoids alone
RADIOFREQUENCY Adaptable for multiple uses in proctology Equally effective for cutting and coagulation. Unit cost much less Portable Inexpensive treatment Easy anal canal access due to variable electrodes Faster healing	LASER Limited applications in proctology surgery Good cutting effect but poor coagulation High instrument cost Limited mobility Costly treatment Limited access in the anal canal. Risk of misdirected reflected beam and delayed wound healing.

unintended activation of hand piece have been reported.

Precautions While Operating a Radiofrequency Unit

Approximately ten seconds should be allowed for the tissues to cool between repeat applications of the electrodes.

The two factors, which make this a good technique, involve the accuracy in power setting on the unit and the swift action of the cutting stroke.

Radiofrequency procedure should not be employed by or on anyone who wears a pacemaker. The instrument should not be used in the

presence of flammable or explosive liquids or gases. The skin under treatment should not be prepped with alcohol.

If proper settings are not known, the operator should start with a low power setting and cautiously increase power until an ideal cut is accomplished, without a tissue drag and no sparking. The finer the electrode used, the less would be the lateral heat spread and thus causing least damage to the adjacent tissues. It is recommended that a hands-on introductory course be taken before attempting the use of this technology.

Other Advantages

Radiofrequency surgery allows cutting without pressure and consequently, there is little tissue damage and minimal scarring. The electrode tip is sterile as is all the tissue being exposed to it. Healing is by granulation, with a soft and supple scar. It could be performed with ease even in the depth and difficult areas like the anal canal. There are minimal incidences of post-operative infection, thereby achieving faster wound healing with negligible use of sutures etc. The electrodes are reusable and may be kept in cold sterilisation solution when not in use.

To conclude, radiofrequency surgery could certainly prove to be a safe and convenient alternative to many of the conventional ano-rectal surgeries as no special operation theatre or arrangements are needed to carry out these procedures. The therapy is cost effective and the instrument needs a little maintenance with no recurring expenditure. MM

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