RADIOFREQUENCY AND ITS USES IN ANO-RECTAL SURGERY

Pravin J. Gupta
Gupta Nursing Home, Laxminagar, Nagpur, India

RADIOFREKVENCIJE I NJIHOVA UPOTREBA U ANOREKTALNOJ HIRURGIJI

Pravin J. Gupta
Gupta Nursing Home, Laxminagar, Nagpur, Indija

Primljen/Received: 02. 02. 2005. Prihvaćen/Accepted: 29. 03. 2005.

SAŽETAK

Elektrohirugija se koristi mnogo decenija u medicini. Radiofrekvencije su talasi veoma visoke učestalosti koji imaju sposobnost da izvrše sečenje, koagulaciju tkiva sa minimalnim koleteralnim oštećenjem. U ovom radu se opisuje lično iskustvo u korišćenju radiofrekventne hirurgije u sprovođenju različitih anorektalnih procedura. Elmanov dvofrekventni talasni generator je korišćen za sprovođenje hirurških procedura. Radiofrekventna hirurgija pospešuje terapiju analne fistule, hemoroida, piluidalnog sinusa i drugih različitih anorektalnih stanja. Hirurške tehnike su lake za učenje, sigurne i efikasne. Najveći broj od njih mogu se izvršiti kao jednodnevne procedure. Procedure su manje bolne u postoperativnom toku, pomažu brzo vraćanje radne sposobnosti i rezultiraju u brzom zarastanju rana.

Klučne reči: radiofrekvencije, proktologija, hemoroidi, analna fistula, elektrokauterizacija

ABSTRACT

Electrosurgery has been used for many decades in medicine. Radiofrequency is an ultra-high frequency current waveform, having properties that perform cutting, coagulation and fulguration of tissues with minimum collateral tissue damage.

Personal experience using radiofrequency surgery in the performance of various ano-rectal procedures is described. The Ellman dual frequency wave-generating device was used to accomplish the surgical procedures.

Radiofrequency surgery facilitates treatment of anal fistula, hemorrhoids, pilonidal sinuses and various other ano-rectal conditions. The surgical techniques are easy to learn, safe and effective. Most of these could be performed as a day care procedure. The procedures are less painful in the postoperative course, help in early return to work and result in rapid healing of wounds.

Keywords - radiofrequency, proctology, hemorrhoids, anal fistula, electrocautery

INTRODUCTION

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 cause contractions in muscle fibers.

Radiofrequency is a refined type of electro surgery that utilizes a wave of electrons at a frequency between 2 and 4MHz to incise, excise, ablate or coagulate the targeted tissue (1).

Radiofrequency surgery has a lengthy documented history of use in oral, ophthalmic, plastic, and gynecology surgery. It was first used for the treatment of snoring. Gradually, its use in the practice of dermatology (2), cosmetology, cardiology, neurosurgery, hepatology, and ENT (3, 4) procedures gained momentum and popularity. It has multi-faceted usages in the respective medical fields (5). However, there have been few published reports of its use in proctology.

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

Radio surgery can simply be termed as an electro surgery at radiofrequency. The term 'radio' is used because the frequency of the device creating these waves is comparable to radio wave frequency used for broadcasting. This high frequency radio surgery and its results should not be confused with diathermy, electric cauterization, or spark producer. With radiofrequency, the targeted tissue temperatures stay localized within a 60–100°C range thus limiting heat dissipation and damage to adjacent tissue. In contrast, electrocautery, diathermy, or laser temperatures are significantly higher (750–900°C) which result in a very high heat propagation, which is far in excess of the desired therapeutic need (6).

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 (7).

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 (8).

The radiofrequency unit - While there are different radiofrequency units in the market, we found the Ellman

Correspondence:
Pravin J. Gupta
Consulting Proctologist
Gupta Nursing Home, D/9, Laxminagar, NAGPUR- 440022, India.
E-mail: drpjg_ngp@sancharnet.in, drpjg@yahoo.co.in
Fax: 49 712 2547837
Phone: 49 712 2231047

dual frequency 4MHz [Ellman International Inc, Oceanside, USA] with a proven and successful history of its efficacy, and being available with a multitude of electrode tips, quite useful to carry out various proctological procedures. The unit produces output power of 100 Watts.



Figure 1. Radio Surgical Unit.

The radiofrequency generator works at two different frequencies i. e. 4 MHz and 1.7 MHz. While the frequency of 4MHz is used for four standard settings like 1. Cutting, 2. Cutting and Coagulation, 3. Pure coagulation and 4.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 delivered by the unit is modified by filtering and rectification to produce one of the four waveforms, namely,

1. Fully filtered- suitable for cutting-produces least lateral heat,
2. Fully rectified- suitable for cutting but which also produces lateral heat to coagulate,
3. Partially rectified modulated-suitable for coagulation and which generates maximum lateral heat,
4. Fulguration- spark gap waveform- to produce desiccation or dehydration.

The fifth mode of waveform is bipolar, which is primarily used in microsurgery and as haemostatic 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.

1. A Needle electrode, which is used for making incisions;
2. Loop electrodes, which are used for excision and shaping tissues;
3. Ball electrode, which is used for coagulation; and
4. Rod electrodes, which are used for fulguration and desiccation of the tissues.

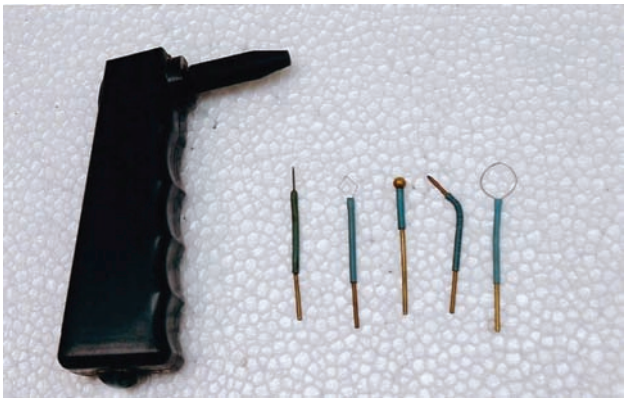


Figure 2. Hand piece and electrodes of the radiofrequency device.

We have been working with this equipment since last 5 years to perform most of the proctological surgeries. The property of simultaneous cutting and coagulation achieved by this machine has attracted us most. 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.

Surgical techniques in ano-rectal lesions

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

While many different electrodes are available with the unit, we could perform most of the procedures 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 'sterilized' 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 large enough, they 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 opened 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 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 Antibiomas

These are also known as antibiotic granuloma, organized 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 clamped and 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 anesthesia 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.

Post-Operative Care

Almost all the abovementioned 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 necessery.

Complications

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

1. Deep dissection can cause more scarring and longer time for healing of the wounds.
2. Excessive release of power produces more smoke and charring.
3. Accidental burns either on the patient or on operator due to unintended activation of hand piece have been reported.

Precautions to be taken while operating with the radiofrequency unit

Approximately ten seconds should be allowed for the tissues to cool between repeat applications of the electrodes. The two factors, which go to make this a good technique, involve the accuracy in power setting on the unit and the swift action of the cutting stroke (9).

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 prepared 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 (10).

Other advantages

Radiofrequency surgery allows cutting without pressure, and, consequently, there is little tissue damage and minimal scarring (11). The electrode tip is sterile, as is all the tissue being exposed to it (12). Healing is by granulation, with a soft and supple scar (13). It could be performed with ease even in the depth and in difficult areas like the anal canal. There is minimal incidence of postoperative infection, thereby achieving faster wound healing with negligible use of sutures, etc. (14).

The electrodes are reusable and may be kept in cold sterilization solution when not in use.

To conclude, radiofrequency surgery could certainly prove to be a safe and convenient alternative to many of the conventional anorectal 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.

REFERENCES

1. Fernando HC, Hoyos AD, Litle V, Belani CP, Luketich JD. Radiofrequency ablation: identification of the ideal patient. Clin Lung Cancer 2004; 6: 149–53.
2. Rex J, Ribera M, Bielsa I, Paradelo C, Ferrandiz C. Surgical management of rhinophyma: report of eight patients treated with electrosection. Dermatol Surg 2002; 28: 347–9.
3. Wedman J, Miljeteig H. Treatment of simple snoring using radio waves for coagulation of uvula and soft palate: a day-case surgery procedure. Laryngoscope 2002; 112: 1256–9.
4. Plant RL. Radiofrequency treatment of tonsillar hypertrophy. Laryngoscope 2002; 112: 20–2.
5. Weber JC, Navarra G, Jiao LR, Nicholls JP, Jensen SL, Habib NA. New technique for liver resection using heat coagulative necrosis. Ann Surg 2002; 236: 560–3.
6. Glover JL, Bendick PJ, Link WJ. The use of thermal knives in surgery: Electrosurgery, lasers, plasma scalpel. Curr Probl Surg 1978; 15: 1–78.
7. Bridenstine JB. Use of ultra-high frequency electrosurgery (radiosurgery) for cosmetic surgical procedures. Dermatol Surg 1998; 24: 397–400.
8. Hettinger DF. Soft tissue surgery using radiowave techniques. J Am Podiatr Med Assoc 1997; 87: 131–5.
9. Valinsky MS, Hettinger DF, Gennett PM. Treatment of verrucae via radiowave surgery. J Am Podtr Med Assoc 1990; 80: 482–8.
10. Brown JS. Radio surgery for minor opeations in general practice. Cosmetic Dermatology 2000: 33–6.
11. Goldberg SN, Gazelle GS. Radiofrequency tissue ablation: physical principles and techniques for increasing coagulation necrosis-Hepatogastroenterology 2001; 48: 359–67.
12. Goldberg SN, Gazelle GS, Dawson SL, Rittman WJ, Mueller PR, Rosenthal DI. Tissue ablation with radiofrequency: effect of probe size, gauge, duration and temperature on lesion volume. Acad Radiol 1995; 2: 399–404.
13. Hurwitz JJ, Johnson D, Howarth D, Molgat M. High-frequency radio wave electosection of full-thickness eyelid tissues. Can J Ophthalmol 1992; 28: 28–31.
14. Gupta PJ. Removal of hypertrophied anal papillae and fibrous anal polyps increases patient satisfaction after anal fissure surgery. Tech Coloproctol 2003; 7: 155–8.