

# Novel Technique: Radiofrequency Coagulation -- A Treatment Alternative for Early-Stage Hemorrhoids

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## Abstract and Introduction

### Abstract

**Background.** For early-stage hemorrhoids, in which bleeding is the primary symptom, conventional approaches to management include injection of sclerosing solutions, band ligation, and infrared coagulation. In our study, we used the radiofrequency coagulation technique as an alternative strategy to treat early-stage hemorrhoids.

**Materials and Methods.** A total of 210 patients with bleeding hemorrhoids were treated with radiofrequency coagulation at the Gupta Nursing Home in Nagpur, India.

**Results.** Follow-up was at 2 weeks, 3 months, and 12 months after procedure. Results were recorded as follows: (1) **Bleeding** - Twenty-eight (13%) patients had recurrence of bleeding during the observation period. (2) **Pain** - Some degree of discomfort was reported by all patients within the first 48 hours. (3) **Retention of urine** - Only 1 patient had retention of urine; this patient was 74 years old and had an enlarged prostate. (4) **Discharge** - Thirty-four (16%) patients complained of discharge in the first 2 weeks after procedure. (5) **Return to work** - Seventy percent (n = 145) of patients resumed their duties after 48 hours; the remainder required 1 additional day. (6) **Sepsis** - There were no reports of postprocedure sepsis. (7) **Sphincter function** - None of the patients experienced problems with continence or stenosis. Overall patient satisfaction was 84% (n = 177).

**Conclusion.** Although these initial results of coagulation of hemorrhoids by radiofrequency appear quite exciting and encouraging, long-term follow-up is needed to assess the duration of relief and potential side effects. Continued work in this area will likely provide promising new dimensions in the effective management of early-stage hemorrhoids in which bleeding is the main symptom. A separate, randomized trial was carried out to assess the difference in efficacy between infrared coagulation and radiofrequency coagulation in 100 patients with early-stage hemorrhoids. Radiofrequency coagulation was found to be more effective than infrared coagulation in terms of recurrence of bleeding, asymptomatic recurrences of hemorrhoids, and overall satisfaction of technique.

### Introduction

The term "hemorrhoids" refers to a common condition occurring worldwide. This condition affects both sexes equally, and although seen more commonly in adults and the elderly, it also affects children.

Because hemorrhoids have a complex and controversial etiology, with different degrees or stages and locations of pathology, no single mode of therapy has proven completely effective. A number of different modalities of treatment have been put forward in accordance with advancements in the fields of surgery and biomedics.

In early-stage hemorrhoids, where bleeding is the primary symptom, bipolar, infrared, and laser coagulation are currently used by practitioners worldwide. These techniques involve the application of bipolar current or infrared or laser light to cause coagulation and necrosis, which then leads to fibrosis in the submucosal layer.<sup>[1]</sup> These techniques are generally effective for internal hemorrhoids of grades I and II. Use of rubber-band ligation, sclerotherapy, cryosurgery, and direct-current probe are in practice for the same purpose.<sup>[2]</sup>

The aim of this study was to assess the utility of radiofrequency coagulation for the treatment of early-stage nonprolapsing hemorrhoids as an alternative to the traditional methods discussed above.

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## Radiofrequency Coagulation

The principle of radiosurgery involves using high-frequency radio waves at 4.0 MHz, delivered at low temperature through radiofrequency microfiber electrodes; the radiofrequency used is similar to the frequency of marine-band radios. The tissue, rather than the electrode, serves as the resistance; therefore, there is no heating of the radiofrequency microfiber electrode. The intracellular water in the tissue that serves as resistance to the waves vaporizes without generating any heat, therefore avoiding the potential damage that may be caused by heat, as is often encountered in electrosurgery. The latter phenomenon is known as cellular volatilization.<sup>[3]</sup> This tissue vaporization also results in significant hemostasis without actually burning the tissue. In addition, there is no danger of shock or burn injury to the patient. Most important is the fact that there is controlled and minimal lateral tissue damage because a very high-frequency radio wave (4.0 MHz) is generated at low temperatures in this technique.<sup>[4]</sup>

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## The Radiosurgical Unit

There are a number of radiosurgical units on the market; we used the *Ellman Dual Frequency* unit by Ellman International, Hewlett, New York. The unit comprises a transformer that converts the main voltage of 220 AC to high voltage and high-frequency energy; its filtering and rectification waves produce 4 different waveforms. The fully filtered and rectified current is used for cutting. The fully rectified current is used for simultaneous cutting and coagulation. The partially rectified current is used for coagulation, and the fulgurating current is used for destruction of large masses.

We have found the partially rectified mode to be best suited for coagulation.<sup>[5]</sup> The ball electrode with a length of 11 cm, which is supplied with the unit, proved useful and was extensively employed for this procedure.

Internal hemorrhoids are normal vascular cushions containing an arteriovenous network. Therefore, a therapy based on reducing downward anal pressure and fixation of the anal cushions to muscular fibers should be the ideal choice.<sup>[6]</sup> Indeed, in this study, we found that fixation of the anal cushions to the muscular fibers could be effectively accomplished with the radiofrequency procedure.<sup>[5]</sup>

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## Materials and Methods

This study was conducted at the Gupta Nursing Home in Nagpur, India, from July 1999 to August 2000, and was designed to assess the efficacy of radiofrequency coagulation in the treatment of hemorrhoids. (Ed. Note: For purposes of context, the author indicates that in India, small hospitals are also termed "Nursing Homes." Therefore, such institutions do not exclusively manage elderly patients.) A total of 210 (180 males, 30 females; see Figure 1) of 733 patients initially screened were treated with radiofrequency energy; follow-up was for 12 months. Mean age of patients was 39 years (range, 17-67 years [8 patients were < 20 years of age, 148 were between 20 and 40 years of age, 54 were > 40 years]; Figure 2). No anesthesia was administered other than 5% lidocaine ointment for anal canal lubrication.

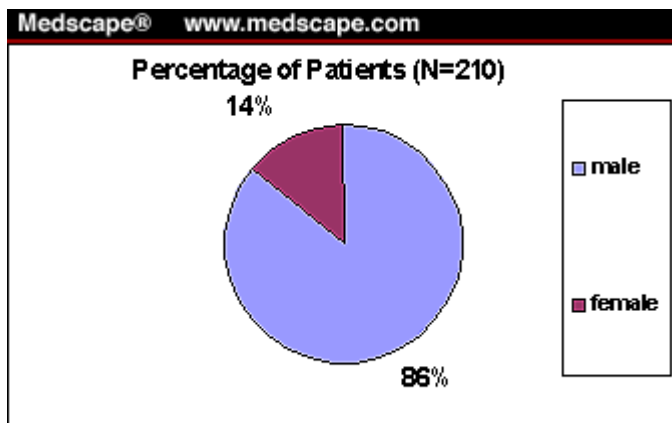


Figure 1.

Patient demographics.

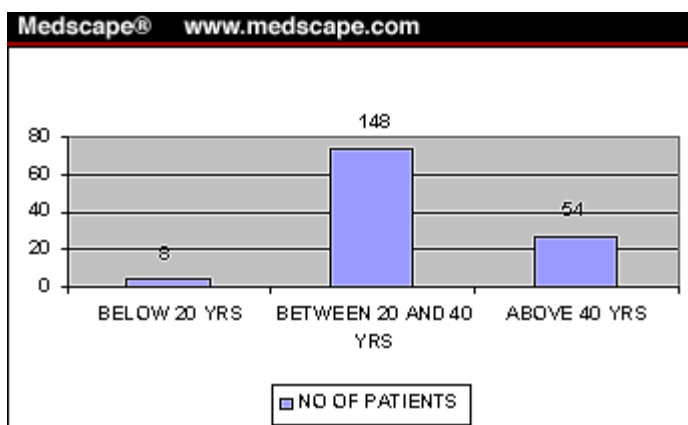


Figure 2.

Age distribution of patients.

#### Diagnosis of Hemorrhoids

Diagnosis of disease was made by rectal and anoscopic examination, and only patients with first- and second-degree internal hemorrhoids were selected for inclusion. All subjects had rectal bleeding, including those with first-degree hemorrhoids with bleeding who had failed to respond to previous conservative treatment (n = 187; previous therapy [mean duration of treatment = 11 months] included laxatives, local anesthetic cream, and drugs such as diosmin).

Patients who had advanced disease (stage III and stage IV hemorrhoids), painful defecation, associated external hemorrhoids, or associated fissure were excluded from the study.

All participants received written explanation of the technique, clearly outlining the potential for relapse and need for repeat procedure. Patients were given the option of selecting any of the other conventional methods of treatment. An informed consent was obtained prior to performing the radiofrequency-based procedure.

#### Procedure

A laxative (2 tablets bisacodyl) was given the night prior to procedure, and patients were asked to report to procedure with an empty stomach.

A generous amount of 5% lidocaine ointment was applied in the anal canal region and the procedure was begun 10 minutes following this application. (It had been previously established that this 10-minute interval post lidocaine administration was sufficient to reduce sensitivity and permit a comfortable procedure.) Patients were kept in the lithotomy position. A gently inserted proctoscope was sufficient to allow a clear view of the entire anal canal and to locate the hemorrhoids. The long ball electrode attached to a special gun handle provided with the instrument was applied to the hemorrhoidal masses until shrinkage was achieved. The masses were observed to turn dusky white in color as a result of coagulation. Care was taken to keep the operative field free of stool or other coatings to prevent obliteration of the view or accumulation of coagulum over the electrode. Occurrence of the latter may also result in the production of more smoke, which can obscure the operative field.

All hemorrhoids were treated during one session, with care taken to leave normal anal mucosa interspersed to avoid subsequent fibrosis and stenosis.

**Postprocedure care.** A mild laxative was prescribed for a period of 1 month after the procedure. Warm sitz baths were recommended to relieve pain and discomfort after defecation. All patients were discharged immediately, except for elderly (defined as those older than 55 years of age or with symptoms of prostatism) males who were discharged only after ensuring that they had no problem passing urine.

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## Results

Patients were followed up after 2 weeks to obtain information regarding pain, bleeding, and anal discharge (Figure 3). Follow-up was repeated at 3 months and at 12 months to collect data on anal stenosis, anal incontinence, recurrence of hemorrhoids, and degree of relief experienced by patients. Proctoscopic examination was not done in the first follow-up to avoid causing discomfort and injury to the healing tissues. Proctoscopic examination was performed during subsequent follow-up at 3 months and 12 months. Findings during follow-up are discussed below.

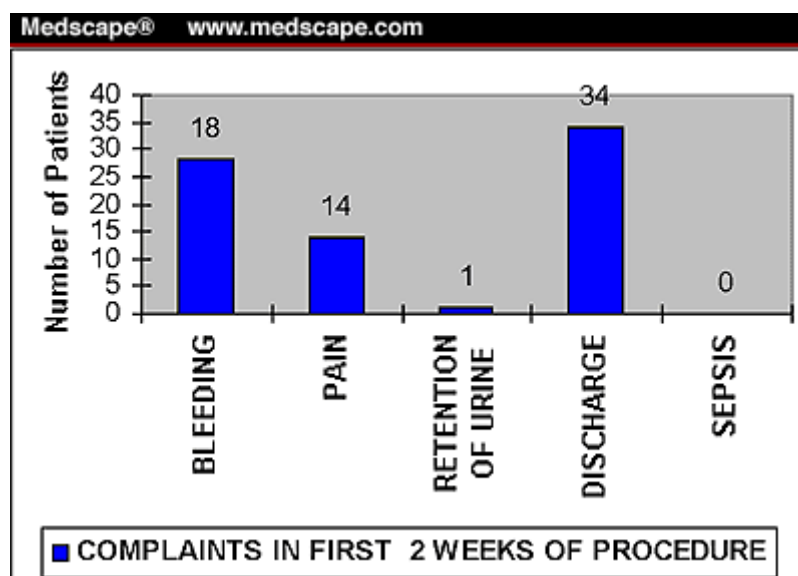


Figure 3.

Findings at follow-up 2 weeks after procedure.

### Observations at 2-Week Follow-up

**Bleeding.** Eighteen patients reported bleeding during this period of observation (12 patients had bleeding during week 1 after procedure; 6 during week 2). Of these 18 patients, 1 had very heavy bleeding, requiring a second procedure.

The main reason for the bleeding was sloughing of the pile mass before complete healing. Incomplete destruction of the entire mass also resulted in bleeding. No specific treatment was advocated, as none was necessary.

**Pain.** All patients reported some degree of discomfort in the first 3 days after procedure, which was relieved by administration of appropriate analgesics; no other use of analgesics was required. (After noting this common complaint during follow-up, it is now our practice to prescribe analgesics such as rofecoxib in appropriate doses, twice daily, for the first 5 days after the procedure.) Pain was more commonly reported among patients who had larger hemorrhoids or in whom coagulation was done close to the dentate line.

**Retention of urine.** One patient experienced retention of urine. However, this patient was 74 years old and had an enlarged prostate. He was catheterized and was relieved; he had no difficulty urinating thereafter.

**Discharge.** Thirty-four (16%) patients complained of discharge in the first 2 weeks. This complication was attributed to the sloughing of the coagulated hemorrhoidal mass because it was observed that patients with second-degree hemorrhoids experienced discharge more often than did patients with first-degree hemorrhoids.

**Return to work.** Seventy percent of patients resumed their duties (employment or routine daily work) after 48 hours; the remaining 30% required 1 or 2 additional days.

**Sepsis.** There were no reports of postprocedure sepsis.

### Observations at 3-Month Follow-up

Six patients were lost to follow-up during this period.

**Bleeding.** Two patients had recurrence of bleeding. In both cases, the procedure was repeated and the complication successfully resolved.

**Proctoscopy.** The site where coagulation was done appeared pale and flat, indicating satisfactory and successful coagulation (n = 203).

There were no reports of pain, discharge, or discomfort.

### Observations at 12-Month Follow-up

Another 11 patients were lost to follow-up during this period.

**Bleeding.** Eight patients experienced bleeding during this follow-up period. These patients were different from those observed in the previous 2 intervals (2 weeks and 3 months) who underwent repeat procedure, in that 3 of these 8 patients refused to undergo repeat treatment. The remaining 5 patients underwent repeat procedure and the complication was resolved.

**Asymptomatic recurrence.** On proctoscopic examination, 18 patients were found to have varicosities at the site of treatment, but they were free of any symptoms. No specific treatment was advised. A mild laxative was suggested to keep the stool soft.

There were no reports of incontinence or stenosis.

**Overall efficacy of the procedure.** More than 84% of patients experienced near total relief from their symptoms, including anal bleeding, pain, and itching. All patients achieved good fecal continence. The latter has resulted in perceptible improvement in quality of life. (Quality of life was assessed by questionnaire and addressed parameters such as improvement in general health, increase in appetite, increased sense of well-being, and ease of defecation.) Obliteration of the treated hemorrhoids, as confirmed by anoscopy, was as high as 89%.

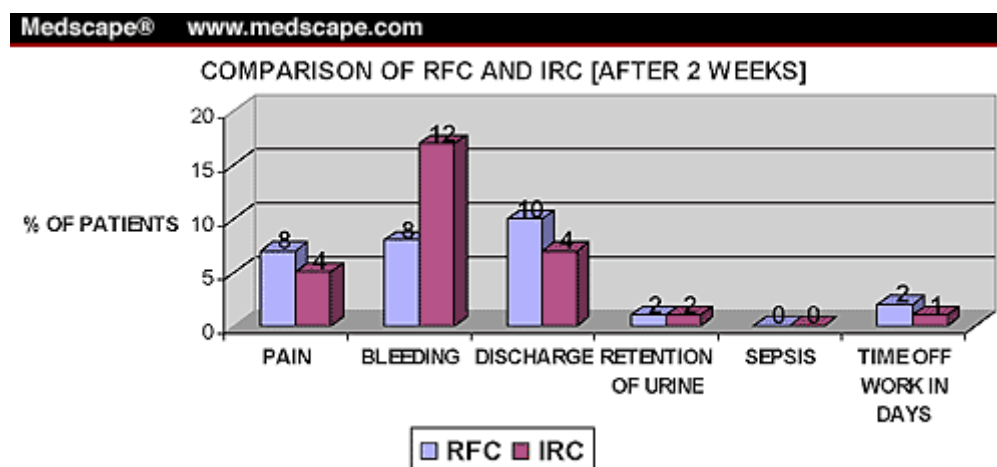
## Comparison of Radiofrequency Coagulation With Infrared Coagulation for the Treatment of Hemorrhoids

Encouraged by the satisfactory results we obtained with the radiofrequency coagulation procedure, we carried out a separate study to compare the efficacy of this technique with that of infrared coagulation.

One hundred patients with first- and second-degree bleeding hemorrhoids were examined; 50 were treated by radiofrequency coagulation and 50 by infrared coagulation. These patients were randomized prospectively to the 2 treatment groups. Randomization was done by sealed envelope which was opened by the surgical nurse upon patient's arrival for treatment; results were blinded.

Infrared coagulation was done at the pedicle of all 3 principal positions of hemorrhoids -- that is, at the 3-, 7-, and 11-o' clock positions, in the same session. In contrast, radiofrequency coagulation was done directly over the pile masses, at similar positions.

Findings from follow-up of patients after 2 weeks are summarized in Figure 4.



**Figure 4.**

Comparative findings at 2 weeks: radiofrequency coagulation (RFC) vs infrared coagulation (IRC).

The higher incidence of pain associated with radiofrequency coagulation is due to the direct coagulation of the hemorrhoids, which may reach up to the dentate line. The duration of the coagulation and the area coagulated in the radiofrequency technique are greater than in infrared coagulation, where only 3 or 4 spot welds of the coagulator are made at the pedicle of the hemorrhoids.

Similarly, the increased frequency of discharge per anus in the setting of radiofrequency coagulation is due to the greater degree of coagulation of the pile mass; thus there is more tissue destruction than in infrared coagulation. Nevertheless, this same phenomenon has helped reduce the incidence of postprocedure bleeding and development of asymptomatic recurrences that are more frequently seen after infrared coagulation.

Data from further follow-up at 1 year are shown in Figure 5. Based on these collective findings, radiofrequency coagulation appears to have benefit over infrared coagulation with respect to recurrence of bleeding, asymptomatic recurrences of hemorrhoids, and overall satisfaction of technique.

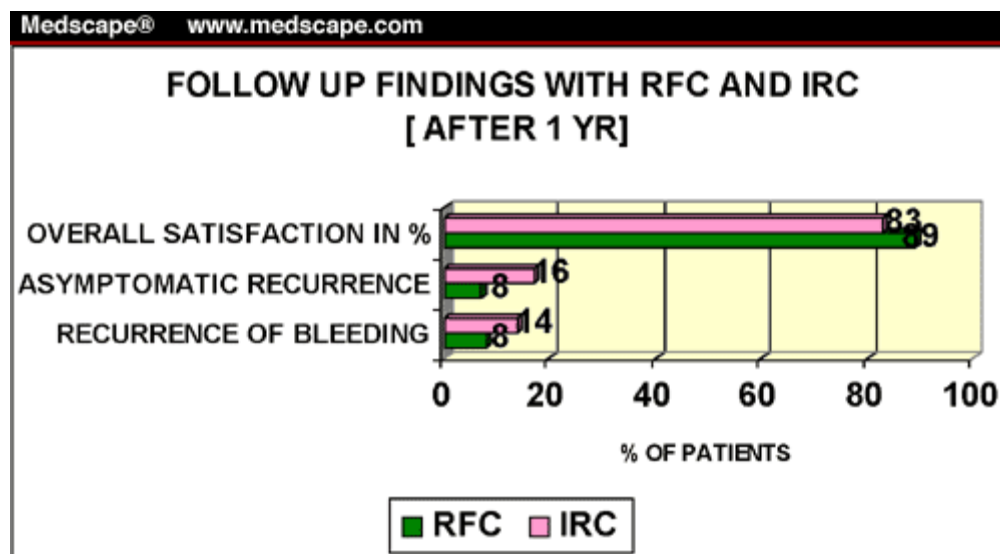


Figure 5.

RFC vs IRC: Data from 1-year follow-up.

## Discussion

Radiosurgery, not to be confused with electrosurgery, diathermy, spark-gap circuitry, or electrocautery, uses a very high-frequency radio wave. Unlike electrocautery or diathermy, the electrode used in radiofrequency surgery remains cold. The latter is possible because of the use of the very high-frequency current of 4 MHz, vs the 0.5-1.5 MHz energy used in the electrocautery procedure. In contrast to true cautery, which causes damage similar to third-degree burns, the tissue damage that occurs with radiofrequency surgery is very superficial and compares well with damage occurring with lasers.<sup>[7]</sup>

Histologically, it has been shown that there is less tissue damage produced with radiosurgery than with a conventional scalpel, and comparable damage to that caused by a cold scalpel.<sup>[8]</sup>

Hemorrhoidal coagulation with radiofrequency energy occurs through the application of a high-frequency current which, when applied to tissue with sufficient current intensity, dehydrates the cells and coagulates their organic contents. This action is evidently self-limiting, because the surface coagulation helps protect the underlying tissues.<sup>[9]</sup>

The results of our study are comparable with those obtained with infrared coagulation and band ligation, as previously observed by Nevah,<sup>[10]</sup> O'Holleran,<sup>[11]</sup> Walker and colleagues,<sup>[12]</sup> and Johanson and Rimm.<sup>[13]</sup>

Radiofrequency coagulation has many advantages<sup>[14]</sup> in the treatment of hemorrhoids. The procedure is safe, easy to perform, and rapid -- coagulation takes generally between 5 and 10 seconds. Additionally, radiofrequency coagulation may be performed as an in-office procedure. In infrared coagulation, the pedicle is coagulated. Thus, the goal is to cut off the vascular supply to the hemorrhoid. However, at times, this coagulation cannot effectively control all of the blood vessels feeding the pile mass. This scenario increases the possibility of incomplete destruction of hemorrhoids or the possibility of recurrence. In radiofrequency ablation, the pile mass is directly coagulated,<sup>[15]</sup> and this facilitates the immediate

disappearance of the hemorrhoid. Radiofrequency coagulation also helps in tethering the mucosa to the rectal wall, which minimizes the chance of recurrence.

The human body essentially reacts as an electrolyte liquid in that the more hydrated the tissue, the more easily the electric current passes through the body.<sup>[9]</sup> Therefore, when the hemorrhoids containing blood (fluid) are exposed to the radiofrequency wave, the fluid is desiccated and the pile mass shrinks.

This procedure is comparatively less expensive than laser therapy, and requires no disposable instruments or costly medications. Additionally, pregnancy is not a contraindication to radiofrequency coagulation -- 4 of the female patients in our study were in their second trimester of pregnancy and were referred by their gynecologist for rectal bleeding. These patients had failed to respond to conservative treatment (oral laxatives, local ointments, nonconstipating diets), and were found to have internal bleeding hemorrhoids. Following radiofrequency coagulation, these patients had an uneventful antenatal period and improvement in their rectal bleeding.

In general, radiofrequency coagulation is a comfortable procedure because it does not require any invasive anesthesia. There may be the need for repeat procedure, but this is seldom resisted by patients as it is quick and safe to perform.<sup>[16]</sup> As compared with laser or electrocoagulation, associated injury to bone or periosteum is unknown in radiosurgery. The associated pain during procedure is much less with radiofrequency coagulation than with band ligation. Moreover, the life-threatening complications such as pelvic cellulitis, tetanus,<sup>[17-19]</sup> recto-vaginal fistula, liver abscess, and bacteremia sometimes associated with band ligation have not been reported in the radiosurgery procedure.<sup>[20-21]</sup> Furthermore, the radiofrequency approach is easily performed without the need for antibiotics or sterile technique (the radiofrequency surgical current provides sterilization while in use). Because of the low level of tissue destruction and controlled direction of the radio wave current, there is generally much less postoperative pain, swelling, and risk of infection than is generally experienced with other techniques.<sup>[22]</sup>

As briefly indicated previously, radiosurgery creates minimal collateral heat damage in the tissue; thus there is rapid healing and no scarring. Biopsies performed of the skin tissue indicate a maximum thickness of heat-denatured collagen of 75  $\mu\text{m}$ ; the latter is equal to (or even better than) that which occurs with carbon dioxide laser used for cutting.<sup>[23]</sup>

Important to note is that during infrared coagulation, the lamp of the infrared coagulator, which is positioned toward the surgeon, heats up after only a few applications and needs to be kept idle for a "cooling down" period between later applications. The latter results in prolonging the overall procedure time and adds to the discomfort of the patient who is lying in an awkward position; this effect does not occur in radiofrequency coagulation. Compared with cryotherapy, in which the time required for procedure is too long and overall patient discomfort much greater, radiofrequency coagulation again represents a quick and pain-free option. Even despite the aforementioned reasons, cryosurgery is not justified as a primary treatment in this setting.<sup>[24]</sup>

As noted earlier, because the frequency employed by the radio wave unit is very high, the current from the instrument passes through the body without causing painful muscle contractions or nerve stimulation (Faraday effects).<sup>[25]</sup> The latter property helps to allow the coagulation of hemorrhoids without anesthesia if the hemorrhoids are above the dentate line. Results achieved with radiofrequency are better than those achieved with sclerotherapy, which is associated with greater discomfort and occurrence of complications such as sepsis and thrombosis. Direct-current probe (*Ultroid*; Cabot Medical, Langhorn, Pennsylvania) has also been promoted as an alternative to conventional procedures for treatment of hemorrhoids. However, the associated procedure time is too long (8-10 minutes or more), resulting in a considerable amount of discomfort to the patient. It is also quite cumbersome for the surgeon to hold the probe for such a long duration. Furthermore, direct-current probe is associated with incidences of sepsis, subsequently leading to abscess and fistula-in-ano.<sup>[26]</sup>



As a final note, the versatility of the radio wave instrument is such that at a frequency of 4 MHz, it can perform cutting, simultaneous cutting and coagulation, and pure coagulation, whereas at a frequency of 1.7 MHz, it can effectively fulgurate/desiccate the tissues. These multiple functions of the radiofrequency equipment are helpful in other anorectal settings as well, including fistula, sentinel hemorrhoids, hypertrophied anal papillae, and fibrous anal polyps.<sup>[16,27]</sup> Thus, the radiofrequency unit may be used as a versatile and multimodal tool in the proctology practice.<sup>[28]</sup>

### Precautions

As with any procedure, radiofrequency coagulation warrants that a number of precautions be taken. Care and vigilance must be exercised when removing a lesion from a patient who is on aspirin or anticoagulant therapy, due to the possibility of increased bleeding. Additionally, the radio wave unit should not be used in the presence of flammable or explosive liquids or gases. The surgeon must also be certain to deactivate the hand piece whenever the electrodes are changed. And, as with all radiosurgery units, a burning smoke is produced; this needs to be addressed in order to avoid the unpleasant smell of burning tissue. The latter may be achieved by employing a vacuum extractor with the aid of an assistant.<sup>[29]</sup>

Finally, radiofrequency coagulation should be performed with caution in patients with a pacemaker.

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### Conclusion

Our initial study findings have demonstrated the efficacy of coagulation of hemorrhoids by the radiofrequency technique. These results are doubtless encouraging. However, long-term follow-up is certainly required for determination of the precise duration of relief achieved and the potential for development of side effects.

We are confident that continued work in this area will show radiofrequency surgery to be a promising new alternative for the management of hemorrhoids -- not only for the treatment of early-stage hemorrhoids in which bleeding is the main symptom, but for other anorectal pathologies as well, such as fistula-in-ano, sentinel hemorrhoids, and external hemorrhoids. The technique of radiofrequency surgery may also prove to be a versatile tool for the practicing proctologist, especially in third-world countries where a single radio wave unit may be effectively used to address multiple anorectal problems, with minimal associated treatment costs for the patients and equally low maintenance costs for the surgeons.

### Disclosure

Dr. Pravin J. Gupta, MS [Gen. Surgery], has disclosed that he will discuss the off-label use of Ellman Dual Frequency 4MHz, also known as Surgitron IEC Radiofrequency Device.

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