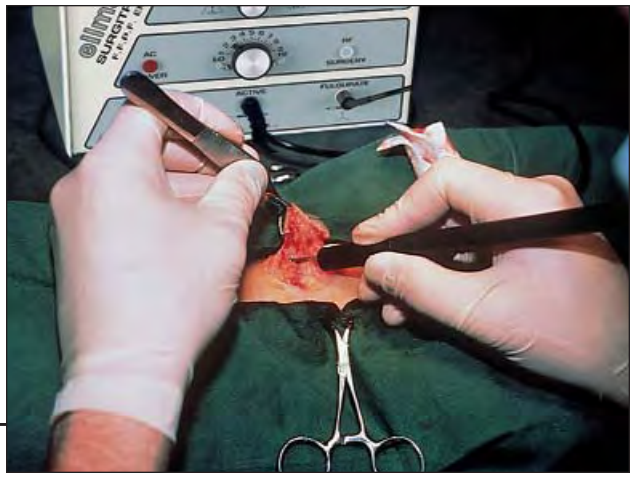
Solving Dermatologic Problems Using Radio Waves



By Lowell Ackerman, D.V.M., Dipl. A.C.V.D

The use of high-frequency radio waves is a relatively new addition to the armaments of veterinary practitioners. This technique should not be confused with radiation therapy or electrocautery. Radio-wave surgery, also referred to as "radiosurgery," uses radio waves of 2-4 MHz—the ideal radio frequency for cutting tissue is approximately 4 MHz—to incise, excise, ablate, and coagulate without damaging surrounding tissue. The frequency generated is intermediate, between that used in AM radio signals and television. Thus, radiosurgery is more like laser surgery than either electrocautery or radiation therapy. The waveform does not generate heat and therefore allows manipulation of tissue with little risk for scar formation. Cutting is accomplished by vaporizing cells in the immediate path of the electrode, causing them to split apart without the need to exert pressure. Adjacent cell layers remain unaffected. The active electrode stays cold but sterile throughout the procedure.

With the exception of orthopedic surgery, radiosurgery can be used for various applications in general practice, including biopsy; surgical excision; and ophthalmic, oral, and general surgery (*Figure 1*). Procedures are done with the animal under general or local anesthesia. The affordable price for a complete unit makes radiosurgery a viable option for most veterinary practices.

Evaluation of Clinical Applications

Clinical applications of radiosurgery were evaluated using the Ellman Surgitron™ (*Figure 2*), which features four currents—fully filtered and fully rectified, fully rectified, partially rectified, and fulguration—and operates at 3.8 MHz and 140 W. The unit acts as a radio transmitter; when the foot pedal is depressed, the waveform is transduced to various handpiece attachments. The radio waves cause water in cells to volatilize. A vacuum, or smoke evacuator, line can be used to remove the plume that may develop over the surgical site. A passive electrode placed under or in the vicinity of the

Figure 1 *(above)*—Radiosurgery has many practical applications for everyday surgical needs. (Courtesy of Ellman International)

Figure 2. The portable Surgitron™ radiosurgery unit. (Courtesy of Ellman International)

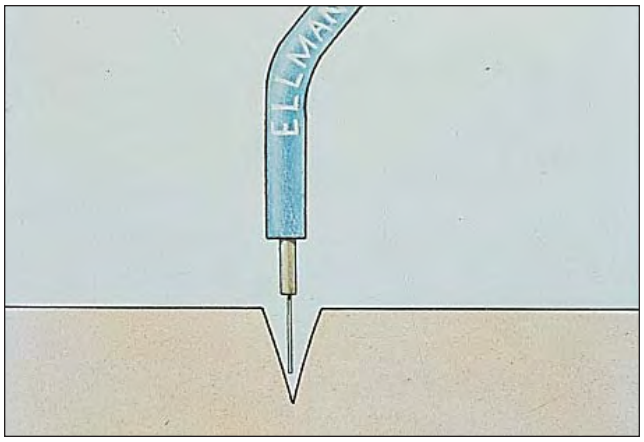


Figure 3. Radiosurgery allows cutting by generating radio waves only from the electrode tip, providing relatively atraumatic separation of tissue. (Courtesy of Ellman International)

patient acts like an antenna that focuses the radio waves; it is not a ground plate. Direct metal-to-skin contact is not needed, and the electrode is coated with plastic to prevent accidental contact and potential burning. The unit is self-grounded; separate grounding of the patient is not required.

Two important goals of surgery are to minimize tissue damage and obtain adequate hemostasis. Both can be readily achieved using radiosurgery. The more the radio waves are rectified and filtered, the less lateral heat will be produced and thus the less tissue damage (*Figure 3*). Minimal lateral heat is produced when the power setting is properly adjusted: The generated heat should be sufficient to coagulate or vaporize the cells and separate the tissue. In addition, the faster the handpiece is moved, the less lateral heat will be produced; the electrode should not be in contact with tissue any longer than needed to produce the desired effect.

The fully filtered and fully rectified setting—90 percent cutting, 10 percent coagulation—is recommended for incisions; paintbrush strokes should be used for cutting. The radio waves cut the tissue without the surgeon "dragging" the instrument. If there is resistance to the cutting procedure, the intensity can be slightly increased. If the setting is too high, sparking will become evident. Moistening the region with square gauze or a swab soaked in water or saline can reduce tissue resistance and encourage the electrode to "glide" through the tissue. Alcohol or spirit-based skin antiseptics should never be used because an errant spark can ignite them. The electrode should be kept clean during the procedure and directed perpendicular to the skin surface. Some hemostasis is provided with the fully filtered setting, but if additional coagulation is needed, the fully rectified setting can be selected. This setting allows cutting with enhanced hemostasis—50 percent cutting, 50 percent coagulation—and the spark-gap output is moderately dampened. Adequate hemostasis is provided for all blood vessels measuring <2 mm in diameter; ligation is recommended for larger vessels.

The fully filtered, fully rectified setting is recommended for incisions.

Additional hemostatic control can be obtained by using a ball electrode or bipolar forceps with the partially rectified setting—10 percent cutting, 90 percent coagulation. Electrofulguration can be obtained by plugging the handpiece into a separate port and holding the electrode 1-3 mm from the tissue and moving the instrument in a manner that causes sparks that result in formation of an eschar. The actual amount of tissue destruction depends on the current intensity, length of time the current flows, density and moisture content of the tissue, and distance between the electrode and the tissue. ➔

Table 1

Advantages and Disadvantages of Radiosurgery

Advantages	*Disadvantages*
Excellent for both cutting and coagulation	Practice necessary to gain proficiency
Rapid local hemostasis	Need for cautious use near combustible chemicals and gases
Minimal tissue damage with good cosmetic effect	Possibility of skin burns if used improperly
Tissue morphology preserved	Unpleasant odor if smoke evacuator (vacuum) is not used
Electrode sterilizes as it cuts	Initial expense of unit
Little postoperative pain	Contraindicated for cutting cartilage or bone
General or local anesthesia can be used	
Unit is lightweight and portable	
Different electrode tips for different applications	
Affordable	

Biopsy and Surgical Excision

Cutaneous biopsy is easy to perform using radiosurgery. For small lesions, a felt-tip marker can be used to define the borders of the lesion before the subcutaneous fat is infiltrated with 1-2 mL lidocaine with or without epinephrine. Germicides do not have to be applied to the skin surface, and alcohol and flammable compounds are contraindicated. Gently touching the surface with a gauze compress moistened with saline or water helps minimize tissue "drag."

For small lesions, a loop electrode is ideal for complete excision. When it is held perpendicular to the skin surface, the loop literally performs a shave biopsy or complete excision, depending on the size of the lesion. The electrode tip should always be activated by the foot pedal or finger switch before it is allowed to contact the skin. When histologic detail is required, only the fully filtered, fully rectified—that is, cutting—waveform should be used because it produces artifact-free biopsies. Once the lesion has been removed, it can be applied to clean dry gauze before being added to a jar of buffered formalin. For long, linear biopsies, it is best to apply the tissue to a piece of tongue depressor or cardboard to decrease folding before adding the sample to formalin. For large lesions, a Vari-tip electrode or a scalpel blade attachment can be used to make an elliptical incision.

The electrode sterilizes as it cuts and thus does not seed infectious agents.

After a biopsy sample is obtained, a gauze square can be used to blot the surface, thereby making the edges and any bleeding more apparent. The blended, fully rectified setting can be used to smooth the edges and provide hemostasis. If there is oozing or incomplete hemostasis, a ball electrode in the partially rectified setting provides additional electrocoagulation. If the sample area contains potentially infected tissue, there should be no concern about spreading infection while obtaining the sample because the radiosurgery electrode sterilizes as it cuts and thus does not seed infectious agents along the incision line. Postsurgical care is limited to keeping the area clean; a topical antiseptic can be used.

Advantages and Indications

Radiosurgery not only has good cosmetic results but can also be used to obtain biopsy samples effectively from a variety of tissues without causing scarring or histologic artifacts

Figure 4—A variety of electrode tips are available for excising cutaneous masses. Shown here is a loop electrode. (Courtesy of Ellman International)

(*Table 1*). Surgical excisions can be done on an outpatient or inpatient basis. The versatility of the procedure accommodates the excision of irregularly shaped lesions that typically could not be adequately sampled by biopsy punch or more conventional surgical approaches. In addition, hemostasis is readily achieved and the procedure can be done aseptically because the waveform sterilizes as it cuts.

Radiosurgery is an excellent tool for removing various cutaneous lesions (*Figure 4*), such as sebaceous gland hyperplasms, skin tags, papillomas, basal-cell tumors, nevi, and keratotic masses. Even deeper and larger lesions can be managed by using the Vari-tip or scalpel blade electrodes to make more traditional elliptical incisions.

In addition to dermatologic applications, radiosurgery is a useful device for performing oral, ophthalmic, and most general surgeries. Because the surgery is virtually bloodless, it has also been extensively used for surgeries in small birds, pocket pets, and various exotic species.

Accepted February 7, 2000

Suggested Reading

Ackerman L. Dermatologic applications of radio-wave surgery (radiosurgery). *Compend Contin Educ Pract Vet.* 1997;19:463-471.

Ackerman L. Radio wave surgery (radiosurgery): applications to clinical dermatology. *Proc Third World Congr Vet Dermatol.* 1996;Sept:102-104.

Brown JS: Radiosurgery: a new instrument for minor operations. *The Practitioner.* 1995;239:446-448.

Brown JS. Radiosurgery. In *Minor Surgery: A Text and Atlas.* 3rd ed. London, England: Chapman & Hall Medical; 1997:300-326.

Nesbitt GH, Ackerman L. *Canine & Feline Dermatology: Diagnosis and Treatment.* Trenton, NJ: Veterinary Learning Systems; 1998:104-106.

***Dr. Ackerman** is director of clinical resources at Mesa Veterinary Hospital, a general, specialty, emergency, and teaching hospital in Arizona.*