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Radiofrequency Ablation: A Nursing Perspective

Julia K. Locklin, RN, MS and Bradford J. Wood, MD

Abstract

Radiofrequency ablation (RFA) has emerged as a safe and predictable technology for treating certain patients with cancer who otherwise have few treatment options. Nurses need to be familiar with all phases of the RFA procedure to create an optimal environment for patients. This article offers a brief review of the RFA procedure and nurses' responsibilities in caring for these patients. Before RFA, nurses should focus on patient education and aggressive hydration. During the procedure, nurses can prevent injury by placing grounding pads appropriately, monitoring vital signs, and medicating patients as needed. After RFA, nurses should assess the skin puncture site, provide adequate pain relief, and, again, hydrate patients. Nurses who care appropriately for RFA recipients may help to improve patient outcomes and make an otherwise frightening procedure more comfortable.

Recent interest in minimally invasive, percutaneous therapies has resulted in less invasive and potentially safer methods of treating patients with cancer who otherwise have few conventional therapy options. Radiofrequency ablation (RFA) has emerged as a safe and predictable technology for thermal ablation in soft tissue and nerve ganglia, as well as in the liver, bone, kidneys, lungs, breasts, lymph nodes, and heart. Certain devices are approved for soft tissue ablation, unresectable liver tumor ablation, and painful bone metastases by the U.S. Food and Drug Administration. This local, minimally invasive, image-guided therapy has been shown to be a safe, effective, and relatively inexpensive treatment for patients who are not surgical candidates (Christians et al., 2001; Goldberg et al., 1998; Livraghi et al., 1997; Solbiati et al., 1997). As RFA becomes available for more widespread use, oncology and radiology nurses should be familiar with how to properly care for patients receiving this treatment. Nurses function as an integral part of a multidisciplinary team in caring for patients undergoing RFA. A brief description of the RFA procedure is presented with an overview of the nurse's role in managing and caring for patients undergoing RFA.

Indications and Contraindications

Although RFA is cleared by the U.S. Food and Drug Administration for ablation of soft tissue, most experience has been in treatment of primary and metastatic tumors of the liver (Curley et al., 1999; Dromain et al., 2002). Use of RFA also has been documented in the successful treatment of osteoid osteoma (Rosenthal, Hornicek, Torriani, Gebhardt, & Mankin, 2003; Woertler et al., 2001), painful bone metastases (Dupuy, Hong, Oliver, & Goldberg, 2000; Goetz et al., 2004), small renal cell tumors (< 3 cm) (Hwang et al., 2004), lung cancer (Gadaleta et al., 2004; Steinke, King, Glenn, & Morris, 2004a, 2004b), adrenals (Mayo-Smith & Dupuy, 2004; Melliza & Woodall, 2000; Wood, Abraham, Hvizda, Alexander, & Fojo, 2003) and painful soft tissue neoplasms (Locklin, Mannes, Berger, & Wood, 2004). RFA also has been used in nerve ganglia for treatment of pain syndromes such as trigeminal neuralgia (Onofrio, 1975; Oturai, Jensen, Eriksen, & Madsen, 1996), cluster headaches (Sanders & Zuurmond, 1997), chronic segmental thoracic pain (Stolker, Vervest, & Groen, 1994), cervicobrachialgia

Author Contact: Julia K. Locklin, RN, MS, can be reached at locklinj@cc.nih.gov, with copy to editor at CJONeditor@jsobel.com.

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(Slappendel et al., 1997), and plantar fasciitis (Solitto, Plotkin, Klein, & Mullin, 1997). Limited use of RFA in breast cancer (Jeffrey et al., 1999) has been documented.

RFA of soft tissue may be indicated if patients are not surgical candidates or refuse surgery or if a tumor is not surgically resectable because of location. Goals for RFA for soft tissue neoplasms include cure, debulking, and palliation. With a goal of palliation or decreasing tumor burden, ablating the entire tumor may not be necessary. Contraindications of RFA include uncorrectable coagulopathies and uncontrolled infection. Otherwise, each patient is evaluated individually, carefully weighing the risks and benefits of using RFA to potentially reach a realistic treatment goal.

Radiofrequency Ablation Procedure

RFA usually is performed on an outpatient basis under conscious sedation, although general anesthesia is preferred by many clinicians to minimize procedural pain. Occasionally, conscious sedation allows for frequent neurologic checks if the ablation zone is near a major nerve. RFA can be performed percutaneously, laparoscopically, or with open surgery. It involves the placement of a thin needle (14–17.5 gauge) into the target tumor under ultrasound, computed tomography (CT), and/or magnetic resonance imaging (MRI) guidance. Grounding pads are placed on the patient and connected to a generator to create a complete electrical circuit. The needle is used as an electrode to deliver alternating electrical current from the generator into the tumor and then to the dispersive electrodes (grounding pads) in the range of radiofrequency (about 500 kilohertz) (see Figure 1). This causes local ionic agitation and subsequent frictional heat. Temperatures in excess of 50°C–60°C cause irreversible thermal damage to the cells, termed coagulation necrosis (Goldberg, 2001). The byproducts of the necrosed tissue are reabsorbed by the body, excreted via the kidneys, and replaced by scar tissue.

The three RFA systems currently available in the United States are the RITA System from RITA Medical Systems, Inc., in Mountain View, CA; Cool-Tip™ from Valleylab, a division of Tyco Healthcare in Boulder, CO; and RF 3000® from Boston Scientific in Natick, MA. Each system has a specific algorithm for treatment.

Nursing Considerations

Preprocedure

Nurses have a role in the pre-, intra-, and postprocedural care of patients undergoing RFA. A multidisciplinary team of providers works to care for patients having RFA procedures. Depending on the various goals of cure, decreasing tumor burden (debulking), or pain palliation, the team may include nurses, interventional radiologists, pain and palliative care service physicians, surgeons, urologists, anesthesiologists, and oncologists. Everyone, including patients and their families, should understand the exact goals of treatment and possible outcomes prior to the procedure (Neeman & Wood, 2002).

Before the procedure, patients need blood tests, including prothrombin time, partial thromboplastin time, complete blood cell count, blood urea nitrogen, creatinine, tumor markers (e.g., alpha fetoprotein, carcinoembryonic antigen), and, if treating the liver, hepatic function tests. Providers need to be made aware of abnormal values. If the platelet count is below 50,000/mm³, nurses should anticipate giving platelets before and/or during RFA. Also, consideration should be made if patients are taking coumadin, heparin, aspirin, or any other anticoagulant. In addition, a chest radiograph and abdominal CT or MRI scan should be performed and results reviewed by the physician to assess for contraindications and help determine the goal(s) of treatment (Melliza & Woodall, 2000).

Patient education is an important part of preparation. Discussion and consensus of the exact treatment goals with patients and their families must be done prior to treatment. Patients should be notified the day before RFA to drink as much as 2,000 ml of fluid (if no history of cardiac or renal insufficiency exists). Small quantities of clear liquids may be allowed up until two hours prior to the procedure but nothing else by mouth until after recovery; however, sedation and anesthesia guidelines may have local practice differences, and nothing by mouth after midnight is a safe order. Nurses should inform patients and their families that being anxious is normal and that anesthesia, conscious sedation, or deep sedation will be administered. Nurses often provide pre-RFA patient education, which can allay many patients' anxieties. Patient materials and handouts are available online at www.cc.nih.gov/drd/rfa.

Intraprocedure

During the procedure, ultrasound and/or CT guidance is most common. The RFA suite is a typical interventional room (CT, angio graphy, or ultrasound) with an RFA system. The ultrasound and the RFA generator must be plugged into different outlets with different circuits to avoid artifacts on the ultrasound monitor during treatments. Patients need IV access, preferably at least 20 gauge, to allow for rapid IV infusion if needed. Oxygen and suction should be immediately available. Nurses should check all equipment for proper working order prior to the procedure. Heart rate, respiratory rate, and oxygen saturation should be monitored continuously and blood pressure recorded at least every five minutes throughout the procedure. Nurses should anticipate giving IV fluids and conscious sedation (usually with midazolam and fentanyl) as ordered. Optimally, patients should be sedated to relieve anxiety after the initial vital signs have been recorded and the sterile area is being prepped but prior to the local skin injection of lidocaine and needle insertion (Sabo, Dodd, Halff, & Naples, 1999). Then, to decrease discomfort associated with the actual burning of the tumor, narcotic or anxiolytic boluses should be given just prior to turning on the current and as needed thereafter. Physicians turn on the current for a standard time period (12–25 minutes at a time), and most pain is apparent at this time. Uncontrolled pain may cause patient movement, irregular breathing, and needle dislodgement or movement from desired position.

Patient comfort is central to safety during RFA. If patients are comfortable, they are more likely to remain still and follow breathing instructions during probe placement, decreasing risk of harm from probe displacement. When patients are sedated, a fine line exists between pain control and ability to follow breathing instructions during probe positioning. Optimally, patients should be sedated deep enough to be comfortable and experience a light sleep but light enough to follow breathing instructions for accurate needle placement throughout the procedure (Sabo et al., 1999). Some patients may require deep sedation (monitored anesthesia care) or general anesthesia to maximize comfort and safety. This often is the case with tumors treated for pain control.

Frictional heat created during RFA may increase body temperature, and it is normal for patients to experience diaphoresis. Removing any blankets covering patients and applying cool, moist cloths increases their comfort. When positioning patients for treatment, pay particular attention to joints and body alignment. Sometimes, positioning patients appropriately while providing for safety and comfort can be challenging. Using padding around the ankles and knees and placing an axillary roll (if patients are in lateral position) improves comfort and decreases risk of injury to bony areas and nerves. In addition, nurses should perform targeted neurologic examinations during RFA if the ablation zone is near a nerve (Sabo et al., 1999).

Although rare, skin burns from grounding pads have been reported. Placing the grounding pads transversely (see Figure 2) on patients' thighs can prevent burns. One pad should be placed on the front of each thigh for a Cool-Tip single-needle probe. If a Cool-Tip triple-needle probe is being used, two additional pads should be placed transversely on the back of each thigh for a

total of four grounding pads. For Boston Scientific and RITA probes, only two grounding pads are required; however, four pads may be wise for large tumors or longer procedures. Before placing, check for any discontinuity in adhesive material on the pad to ensure complete contact with patients' skin. During treatment, nurses are responsible for checking the grounding pads periodically for complete adhesion to the skin and for increasing temperature of the skin and pads. Warm skin is normal, but it never should be hot and red. The grounding pads should be removed while patients still are sedated. The pads should be removed gently but rapidly by rolling away from the skin, giving particular attention to skin integrity. Also, if a lesion being treated is close to the skin, monitoring of local skin temperature is imperative and may require sterile ice packs placed on the treatment site to prevent skin burns. RITA now has grounding pads with temperature monitors built in. Adrenal tumors and liver lesions located in the right lobe near the adrenal gland have been reported to rarely precipitate hypertensive crisis during RFA, so these may need to be performed with anesthesia assistance and an arterial hemodynamic line.

Postprocedure

After the needle is removed, an adhesive bandage at the skin puncture site is typically the only dressing required. If the liver has been treated, positioning a patient on his or her right side for at least one hour may put pressure on the site, possibly decreasing the chance of bleeding. Hematuria is unusual but may be normal after kidney ablation and should resolve over 8–24 hours. Major immediate complications may include electrolyte imbalance, bleeding, bowel perforation, and grounding pad burns (Rhim et al., 2004). Nurses should monitor vital signs, including temperature, intake and output, and skin integrity, closely and report any changes to the physician. Although uncommon, minor complications may include pain, shoulder pain, fever, nausea, vomiting, arthralgia, headache, and tiredness (Rhim et al.). Procedural and anesthesia complications also may occur, such as aspiration pneumonia or pulmonary embolism. Early ambulation following RFA may help to prevent these. Major complications from liver RFA have been reported, including peritoneal hemorrhage, neoplastic seeding, intrahepatic abscesses, and intestinal perforation, although in only 2.2% of cases (Livraghi et al., 2003). This rate may not reflect complications from extra-abdominal RFA procedures. Major, site-specific complications may include pneumothorax with lung RFA and weakness or paralysis of RFA near a nerve.

Pain medication should be given as needed postprocedure, with consideration of pain type and intensity, duration, past experiences with pain, and responses to analgesics for pain relief or side effects (Gordon et al., 2004). Nurses should perform a thorough pain assessment, including minimum pain intensity, temporal characteristics of the pain, and impact on daily function (Gordon et al.). Inpatients may benefit from patient-controlled analgesia (PCA), which should be immediately available post-RFA. Starting PCA preprocedure may facilitate this. Instructions should be given to patients on the use of PCA with the goal of obtaining a pain rating that allows a patient to recover with relative ease (Sullivan, 2004). In addition, ketorolac in 30 mg boluses every six hours is quite useful as a one- or two-time dose for opiate-resistant postprocedure pain. This nonsteroidal anti-inflammatory drug provides additional analgesia without the opioid effect of respiratory depression but carries nephrotoxicity risks. If patients have a history of chronic pain, consultation with the pain service, if available, may improve patient outcome (Sullivan). RFA at the dome or capsule of the liver near the diaphragm usually causes more pain, which may radiate to the shoulder. In addition, RFA at the dome of the liver has been associated with pleural effusion and requires close monitoring of the patient's respiratory status in the days and weeks following RFA.

Postprocedure, continued hydration is important to flush the kidneys of byproducts of the ablation and may limit renal toxicity or acute tubular necrosis from contrast or postablation

syndrome. IV fluids should be given as ordered by physicians, and nurses should encourage oral fluids up to two liters over the following 24 hours (if no cardiac or renal insufficiency exists). Patients are adequately hydrated if they are urinating every two to four hours. Temperatures greater than 100.9°F should be reported immediately to the physician. Postprocedure resumption of diet depends on usual anesthesia or sedation guidelines.

Postablation syndrome is characterized by low-grade fever, aches, mild flu-like symptoms, and a general feeling of malaise and may be similar to a mild tumor lysis syndrome. Patients should be aware that these mild symptoms are normal and they should continue hydration for the next five to seven days. Postprocedure instructions also should include monitoring for signs of infection and taking temperature three times per day. Patients should call their physicians if their temperature is greater than 100.9°F. A post-procedure course of antibiotics may be given to patients with neutropenia, ascites, choledochenteric anastomoses, sphincterotomy, prior hepatic arterial chemotherapy, focal biliary dilatation, kidney tumors, or central, portal, or large hepatic lesions. Patients also may resume their normal levels of activity as tolerated usually 24 hours after RFA.

Minimally invasive cancer therapy is an emerging field with an increasing number of indications. Nurses have an opportunity to improve outcomes by being aware of their role in care of patients receiving RFA. Nurses possess the ability to create a safe and comfortable environment for these patients. For more information, visit www.cc.nih.gov/drd/rfa.

Rapid Recap

Radiofrequency Ablation: A Nursing Perspective

- Radiofrequency ablation (RFA) is a minimally invasive, image-guided procedure that is approved by the U.S. Food and Drug Administration for soft tissue ablation, unresectable liver tumors, and painful bone metastases.
- Local temperatures in excess of 50°C–60°C cause irreversible cell damage, termed coagulation necrosis.
- RFA is the process of causing local coagulation necrosis by creating an electrical circuit and applying alternating current in the range of radiofrequency to selected tissue.
- With appropriate nursing actions, patients are likely to have a safer and more comfortable RFA procedure.
- Nurses are an integral part of the interdisciplinary team caring for, assessing, and managing patients receiving RFA.

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Figure 1. Radiofrequency (RF) Ablation

Note. The patient becomes a complete electrical circuit. Grounding pads are placed transversely on the thighs. The grounding pads and RF probe are connected to the RF generator. Local ionic agitation is created at the probe tip by the application of electricity in the frequency of radio waves.

Figure 2.
Grounding Pads Placed Transversely on a Patient's Skin to Help Prevent Skin Burns