Radiofrequency (RF) interstitial tissue ablation is a new, minimally invasive procedure for patients with liver cancer who are not candidates for conventional therapy. The percutaneous RF ablation therapy involves placing a needle electrode under ultrasound guidance into a selected portion of the tumor and heating the tissue between 90°C and 100°C.

The ablation procedure can be done under monitored anesthesia care on an outpatient basis. The patient’s ability to cooperate with regard to breathing is critical for accurate needle placement. Intravenous sedation must be meticulously titrated to maintain a delicate balance of patient cooperation and optimal comfort.

Key words: Intravenous sedation, liver tumors, patient comfort and cooperation, radiofrequency tissue ablation.

Introduction
Radiofrequency (RF) interstitial tissue ablation is a new, minimally invasive treatment for patients with liver cancer. According to the National Cancer Institute, about 18,500 patients are diagnosed with liver cancer each year. The patient prognosis is very poor, as untreated patients usually die in 3 to 4 months, and with treatment, patients usually die in 6 to 18 months. Often, patients are not candidates for conventional resection therapy, due to an unfavorable location for tumor resection, limited hepatic reserve, extensive intrahepatic tumor extension, or an impaired medical condition. The RF ablation technique is a new procedure that can be done under intravenous sedation on an outpatient basis on some patients with small tumors, for whom surgery is not a viable option.

Background
Percutaneous RF tissue ablation therapy was introduced in 1990 by McGahan et al. The majority of experimental work has been done in Europe, primarily in Italy by Rossi. There are currently 4 institutions in the United States where RF thermal ablation treatments are being performed on hepatic tumors. At our institution, the University of Texas Health Science Center in San Antonio, Tex, the radiology and surgery departments are conducting a large prospective investigation to evaluate the effectiveness of ultrasound-guided RF thermal ablation for the treatment of primary and secondary malignant hepatic tumors. Since June 1996, we have treated 30 patients. The majority of patient procedures have been performed in the radiology suite under monitored anesthesia care (MAC) with full general anesthesia available if necessary. Monitored anesthesia care with careful titration of sedation has provided good patient comfort and a short recovery time with no serious anesthetic complications.

Preoperative evaluation
Patients who meet the clinical and imaging criteria for the study are required to have an electrocardiograph, specific blood work, and imaging studies done before the procedure. A preoperative electrocardiograph will help with the evaluation of referred right arm or chest pain, which sometimes occurs due to the close proximity of the tumor to the diaphragm.

The blood tests consist of a complete blood cell count, chemistry profile, serum ammonia, pro-
thrombin (PT) partial thromboplastin time (PTT), and a hepatitis screen. Due to the presence of liver disease, a PT, PTT, and platelet count are checked. If the platelets are below 50,000, 6 units of platelets are infused prior to the procedure, and fresh-frozen plasma is administered if indicated.

Anesthetic considerations

Following admission to the outpatient department, patients are transferred to the radiology suite, where a blood pressure cuff, electrocardiograph, and oxygen saturation monitor are applied. An 18-gauge intravenous catheter is inserted, and a balanced salt solution is infused.

Supplemental oxygen is administered via a nasal cannula with a port for monitoring endtidal carbon dioxide. Sedation and analgesia are provided with midazolam and fentanyl prior to the local skin injection of lidocaine and needle insertion. It is important that the patient be able to cooperate and hold his or her breath for the needle insertion under ultrasound guidance. The patient’s ability to cooperate with regard to breathing is critical for accurate needle placement throughout the procedure.

The procedure involves placing a 15-gauge needle electrode through a small skin incision into a selected portion of the tumor. A plunger at the proximal end of the needle is advanced to push 4 curved electrodes into the tumor. An alternating electrical current is then applied, which causes local ionic agitation around the electrodes. The agitation causes the temperature of the adjacent tissue (tumor) to rise. The tissue is heated to a target temperature of 90 °C to 100 °C for 6 minutes. A single ablation will produce a 3-cm spherical thermal injury. Tumors less than 3 cm can be killed with a single ablation. Larger tumors require multiple overlapping ablations. Each ablation lasts about 10 minutes with a maximum of 12 ablations performed in a session. The procedural duration ranges from 1 hour for solitary tumors to 3½ hours for larger or multiple tumors.

A remifentanil infusion rate of 0.03 to 0.12 µg/kg per minute and incremental doses of midazolam are administered during the ablation. The combination of remifentanil and midazolam provides excellent sedation and helps minimize the discomfort associated with feeling “hot” from the heat generated during the procedure. Remifentanil is easily titratable, and the quick onset and offset is ideal for this procedure. An antiemetic usually is administered at the end of the case. Patients tolerate RF tissue ablation very well under MAC and have not experienced any significant anesthesia-related complications. A delicate balance of patient cooperation and adequate sedation for a prolonged period of time, however, requires scrupulous attention and careful titration of intravenous drugs.

Recovery

Following the ultrasound-guided RF thermal ablation procedure, the patients are monitored in the recovery area for 4 to 6 hours. The extended recovery period is required primarily to observe the patient for bleeding. To date, we have only had 1 complication occur, a large intrahepatic hematoma that was successfully managed by transfusion of 6 units of packed red blood cells and transcatheter arterial embolization. If vital signs are stable after 4 hours, the attending radiologist discharges the patient.

Summary

Ultrasound-guided RF interstitial tissue ablation is a new, minimally invasive method for treating small malignant hepatic tumors. The percutaneous procedure can be done under MAC on an outpatient basis in patients for whom resection is not an option. Intravenous medication must be titrated meticulously during the procedure for maximum patient comfort and optimal patient cooperation for ultrasound-guided percutaneous needle placement.

REFERENCES


AUTHORS

Betsy Sabo, CRNA, BS, is a staff nurse anesthetist at the University of Texas Health Science Center in San Antonio, Tex.
Gerald G. Dodd, MD, is a professor of Radiology at the University of Texas Health Science Center in San Antonio, Tex.
Glenn A. Half, MD, is the director of the Division of Organ Transplantation in the Department of Surgery at the University of Texas health Science Center at San Antonio, Tex.
Joseph J. Naples, MD, is a professor of Anesthesiology and deputy chairman for Clinical Affairs at the University of Texas Health Science Center in San Antonio, Tex. Dr. Naples is also chief of Surgical Services and holds a cross-appointment as professor of Surgery in the division of thoracic and cardiovascular surgery.