Implantable cardioverter defibrillators (ICDs) have become the standard treatment for patients at high risk of sudden death due to ventricular arrhythmias. Because implantation of an ICD is not a cure, the risk of recurrence of arrhythmia is not reduced, and frequent sequential ICD shocks can cause patients marked discomfort. This discomfort accounts for decreased acceptance of the device and a decreased quality of life among patients. Although pharmacological treatment of ventricular tachycardia can help reduce recurrences of sustained arrhythmia, antiarrhythmic drugs have been associated with low efficacy, proarrhythmic actions, and frequent toxic effects or long-term adverse effects. These problems associated with pharmacological therapies have prompted a search for alternative approaches to decrease recurrence of potentially lethal ventricular dysrhythmias. One of these approaches involves ablation of the arrhythmogenic myocardial focus.

With radiofrequency ablation, alternating current is delivered in low voltage (typically 40 V) for 30 to 60 seconds to cause controlled thermal injury of the contacted myocardial tissue. This current is delivered between a catheter tip and an indifferent electrode (ground patch). The lesion created is discrete and its location is precisely defined, with minimal risk of damage to adjacent structures. Irreversible injury occurs when the myocardial tissue reaches a temperature of 48°C to 50°C.

Radiofrequency ablation has revolutionized therapy of most forms of supraventricular tachycardia and ventricular tachycardia in patients without structural heart disease by providing arrhythmia cure in almost 90% of cases. These types of tachycardia are due to an arrhythmia focus that occurs in a fixed location, providing a precise target and making the tachycardia more amenable to treatment by ablation. Most cases of ventricular tachycardia in patients without heart disease originate from...
1 of 2 locations: the right ventricular outflow tract or the left ventricle. However, ventricular tachycardia in patients without structural heart disease is uncommon, accounting for less than 10% of all patients with ventricular tachycardia.

Treatment of ventricular tachycardia in patients with structural heart disease has not been nearly as successful. Use of ablation to treat ventricular tachycardia in such patients is a valuable adjunct to treatment with ICDs, mainly to decrease recurrence of the clinical arrhythmias and the frequency of ICD shocks. Most sustained monomorphic ventricular tachycardias are caused by reentry involving a region of ventricular scar. The scar is most often caused by an old myocardial infarction, but right ventricular dysplasia, sarcoidosis, Chagas disease, other nonischemic cardiomyopathies, and scar related to surgical repair can also cause reentry.

In the weeks after a myocardial infarction, the healing infarct undergoes structural changes. Fibrosis creates areas of conduction block and also increases separation of myocyte bundles, slowing conduction through myocyte pathways in the border of the infarct. These pathways can support reentry circuits, leading to monomorphic ventricular tachycardia. The best target for ablation of scarred tissue causing tachycardia is usually within these zones of slow conduction.

The reentry circuits associated with ventricular scar can be difficult to define. The situation is further complicated by the presence of multiple reentry circuits, giving rise to multiple different monomorphic ventricular tachycardias. The approach to ablation depends on the stability and number of ventricular tachycardias targeted for ablation and the location of the ventricular scar. Limitations of ventricular tachycardia ablation to date have included imprecise mapping tools, limited efficacy, multiple sites of origination of arrhythmia, unstable hemodynamic status during the arrhythmia, and unpredictable changes in the myocardial scar tissue.

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**Anatomy of a Scar**

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**Mapping**

A number of mapping techniques have been developed to assist in the accurate localization of the reentrant circuit and detect critical regions for ablation. QRS morphology of ventricular tachycardia can be used as a starting point for localizing the source of the arrhythmia when the ventricles are structurally normal but can be misleading and less reliable in patients who have structural damage due to infarction or scarring. The QRS morphology of focal-origin ventricular tachycardia is largely determined by the location of the focus of the arrhythmia. Ventricular tachycardias associated with scarring have a QRS morphology indicative of the exit location of the reentry circuit.

Previous mapping techniques include activation-sequence, pace-mapping, and entrainment approaches. These approaches are often used during the tachycardia by means of a steerable mapping catheter. Activation mapping involves maneuvering the ablation catheter to a site where the tip records electrical activity generated earlier than at any other endocardial site.

For patients with unstable or noninducible ventricular tachycardia, pace mapping during sinus rhythm is done at sites around the infarct region in an attempt to produce a QRS morphology similar to that of the spontaneous ventricular tachycardia. Entrainment mapping involves pacing from the ablation catheter to a site where the tip records electrical activity generated earlier than at any other endocardial site.

In the rest of this article, I discuss using advanced mapping techniques to better localize the origin of the ventricular tachycardia in order to improve applicability and effectiveness of ablation in treating this arrhythmia. I also review nursing care before, during, and after the procedure and essential monitoring requirements, risks, and complications.
and QRS morphology to confirm location within the reentry circuit. This approach is most applicable if the ventricular tachycardia is easily induced, sustained, and hemody-
namically stable.\(^9\)

However, many patients with sustained monomorphic ventricular tachycardia, particularly patients with multiple infarctions or nonis-
chamic cardiomyopathy, have marked left ventricular dysfunction and may not be able to maintain a stable hemodynamic status during the ventricular tachycardia to allow necessary mapping.

With the development of more advanced mapping systems, “sub-
strate mapping” has been added to previous mapping techniques. Such mapping allows identification of the reentrant area during stable sinus rhythm, a step that minimizes mapping during ventricular tachycar-
dia. Use of an anatomically based approach during sinus rhythm might extend the applicability of ablative therapy. Such an approach could also reduce procedural time, subsequent radiation exposure, and the number of radiofrequency lesions. Theoretically, limiting the number of radiofrequency lesions to the minimum required for success is desirable, because the risk of damage to functioning myocardium and the creation of potentially thrombogenic endocardial lesions are minimized.\(^{10}\)

In fewer than 5 years, several advanced mapping systems have been developed, including noncontact mapping (Ensite 3000, Endocardial Solutions, St Paul, Minn), basket catheters, CARTO-XP (Biosense-Webster, Diamond Bar, Calif), and the Real-Time Position Management System (Boston Scientific, Natick, Mass). The Real-Time Position Management System allows electroanatomical mapping by means of a combination of electrophysiologi-
acal measurements and anatomical information derived from ultrasound imaging.\(^{11}\) Selection of appropriate target sites is based on a combina-
tion of these 2 functions. In this sys-
tem, an ultrasound ranging technique enables multiple distance measure-
ments between 2 reference catheters positioned in the coronary sinus and the right ventricle and a mapping catheter positioned in the left ventri-
cle. Each catheter is equipped with ultrasound transducers. Areas show-
ing recordings of low-voltage electro-
grams are used to detect scarred myocardium. A diminished bipolar electrogram amplitude of less than 1.5 mV is considered a marker of scarred myocardium; dense scar has a voltage of less than 0.5 mV.\(^{12}\) Plots of electrogram amplitude, referred to as voltage maps, clearly delineate the infarcted region (see Figure).

By moving the ablation catheter from point to point around the ven-
tricle, the electrogram signals can be displayed as color gradients. Normal

<table>
<thead>
<tr>
<th>Tachycardia</th>
<th>Typical QRS morphology</th>
<th>Origin of tachycardia by QRS morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focal-origin ventricular tachycardia</td>
<td>Left bundle branch block, inferior axis</td>
<td>Right ventricle or septum, anterior wall</td>
</tr>
<tr>
<td>Idiopathic right ventricular outflow tract</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventricular tachycardia involving His-Purkinje system</td>
<td>Left bundle branch block, rarely right bundle branch block</td>
<td>Right ventricle or septum, left ventricle</td>
</tr>
<tr>
<td>Bundle branch reentry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitral annulus</td>
<td>Right bundle branch block, inferior axis</td>
<td>Left ventricle, anterior wall</td>
</tr>
<tr>
<td>Ventricular tachycardia involving left ventricular verapamil-sensitive tachycardia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right bundle branch block, superior left or right axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scar-related ventricular tachycardia</td>
<td>Variable</td>
<td>Variable—primarily left ventricle</td>
</tr>
<tr>
<td>Previous myocardial infarction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right ventricular dysplasia</td>
<td>Left bundle branch block</td>
<td>Right ventricle or septum</td>
</tr>
<tr>
<td>Chagas disease</td>
<td>Variable</td>
<td>Variable</td>
</tr>
<tr>
<td>Tetralogy of Fallot</td>
<td>Left bundle branch block or right bundle branch block</td>
<td>Right or left ventricle</td>
</tr>
<tr>
<td>Sarcoidosis</td>
<td>Variable</td>
<td>Variable</td>
</tr>
</tbody>
</table>
amplitude areas (>1.5 mV) are indicated by purple; progressively lower amplitude regions are indicated by blue, green, yellow, and red. Dense scar is color-coded red. These areas can then be targeted for ablation.

**Ablation**

Ablations can be done on either an outpatient basis or while the patient is hospitalized for incessant ventricular tachycardia. If an ablation is done on an outpatient basis, preprocedural instructions including no food or drink after midnight, the need for a designated driver, required laboratory tests, and medication instructions are given (Table 2). Procedures generally last 3 to 4 hours, and patients are monitored for 4 hours after sheath removal to allow adequate recovery from sedation and stabilization of vascular access sites. Patients may be discharged after the 4-hour recovery or may be admitted to the hospital overnight for closer observation.

**During the Procedure**

During the procedure, patients are sedated by using a moderate sedation protocol with a combination of midazolam and fentanyl citrate. Diphenhydramine may be added. Heart rate, blood pressure, pulse oximetry readings, and carbon dioxide levels are monitored every 5 minutes. The response to sedation is assessed by using the Richmond Agitation Sedation Scale. Multiple venous sheaths are typically placed in the femoral veins for positioning electrode catheters high in the right atrium, the right ventricular apex, the bundle of His, and the coronary sinus.

The left side of the heart can be accessed in 1 of 2 ways: a transseptal approach or a retrograde approach. An arterial catheter is placed in the femoral artery for retrograde approach and continuous monitoring of blood pressure. Because platelet activation, thrombin formation, and fibrinolytic activation can occur after ablation, systemic anticoagulation with intravenous heparin is necessary while catheters are present in the left side of the heart. Anticoagulation status is monitored by measuring activated clotting time. The time is determined 10 minutes after every heparin bolus and then every 30 minutes to maintain a value greater than 250 seconds while catheters are in the left side of the heart.

Electroanatomical mapping of the left ventricle is performed by using 2 reference catheters, the ablation catheter, and the Real-Time Position Management mapping system. The 2 reference catheters are placed via the right femoral vein and positioned in the right ventricular apex and either the coronary sinus or high in the right atrium. An 8- or 10-mm-tip ablation catheter is positioned in the left ventricle. Radiofrequency lesions are created in sinus rhythm or during hemodynamically stable ventricular tachycardia around the scar at the border zone or at critical points in the scar that are required for ventricular tachycardia. An 8- or 10-mm ablation catheter is used to create the larger deeper lesions needed to eliminate reentry circuits, which may occupy several square centimeters.
Table 2  Ablation pathway for outpatients

<table>
<thead>
<tr>
<th>Before procedure</th>
<th>During procedure</th>
<th>After procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tests</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obtain complete blood cell count, results of chemistry panel, urea nitrogen level, creatinine level, digoxin level, prothrombin time, partial thromboplastin time, international normalized ratio, level of human chorionic gonadotropin (if patient is premenopausal)</td>
<td>Obtain activated clotting time (ACT) at baseline, 10 min after each heparin bolus, and then every 30 min while patient is receiving heparin</td>
<td>Obtain electrocardiogram for any recurrence of tachycardia</td>
</tr>
<tr>
<td>Obtain 12-lead electrocardiogram</td>
<td>Obtain ACT every hour until &lt;170 s for sheath removal</td>
<td>If patient is diabetic, resume measuring blood glucose level via fingerstick before meals and bedtime</td>
</tr>
<tr>
<td>Be sure international normalized ratio &lt;1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check need for transesophageal echocardiography</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If patient is diabetic, check blood glucose level via fingerstick</td>
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<td></td>
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</tr>
<tr>
<td><strong>Assessment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review history and findings on physical examination</td>
<td>Do final verification and time out Check airway, American Society of Anesthesiology scale, baseline SaO₂ on room air, and need for continuous positive airway pressure</td>
<td>Obtain vital signs, sedation score, pain score every 15 min for an hour, then every half hour for an hour, then every hour for 2 h, and every 4 h for 24 h</td>
</tr>
<tr>
<td>Obtain history of allergies, measure height and weight</td>
<td>Obtain vital signs, respiratory rate, pulse oximetry reading, carbon dioxide level every 5 min</td>
<td>Check insertion sites when obtaining vital signs: check for bleeding, swelling, hematoma</td>
</tr>
<tr>
<td>Get consent form for conscious sedation and procedure signed and witnessed</td>
<td>Monitor and record score on Richmond Agitation Sedation Scale and pain score every 5 min</td>
<td>Monitor for signs of potential complications: pericardial effusion, femoral bleeding or hematoma, stroke</td>
</tr>
<tr>
<td>Ensure patient has a designated driver (if outpatient)</td>
<td>Obtain vital signs immediately if arrhythmia occurs and assess level of consciousness</td>
<td>Measure input and output</td>
</tr>
<tr>
<td>Obtain baseline vital signs, arterial oxygen saturation (SaO₂), Aldrete score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check for history of any problems with anesthesia or history of sleep apnea and need for continuous positive airway pressure</td>
<td>Measure intake and output</td>
<td></td>
</tr>
<tr>
<td>Begin patient identification process</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Treatments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Be sure intravenous saline lock is patent, 20-gauge or larger</td>
<td>Apply defibrillation pads, set at 360 J</td>
<td>Maintain intravenous heparin lock until discharge</td>
</tr>
<tr>
<td>Insert urinary catheter if inpatient ablation</td>
<td>Check programming of implantable cardioverter defibrillator (ICD) or permanent pacemaker (PPM), and turn ICD to monitor only or off (if ordered)</td>
<td>Wean patient off supplemental oxygen to keep SaO₂ &gt;94%</td>
</tr>
<tr>
<td></td>
<td>Insert urinary catheter if outpatient ablation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connect arterial catheter to transducer for continuous monitoring of blood pressure or transseptal approach (if ordered)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Apply cautery pads as per procedure:</td>
<td></td>
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<tr>
<td></td>
<td>-1 for 4- to 5-mm-tip ablation catheter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-2 for 8- to 10-mm-tip ablation catheter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Administer supplemental oxygen as needed to keep SaO₂ &gt;94%</td>
<td></td>
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<tr>
<td></td>
<td>Shield gonads</td>
<td></td>
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<tr>
<td></td>
<td>Cardiovert/defibrillate as needed for induction of arrhythmia not responsive to termination by pacing or ICD therapy</td>
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</tr>
<tr>
<td></td>
<td>Remove sheath when ACT &lt;170 s</td>
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<tr>
<td></td>
<td>Return PPM/ICD to preprocedural settings at end of procedure</td>
<td></td>
</tr>
</tbody>
</table>

Continued
**Table 2  Continued**

<table>
<thead>
<tr>
<th>Medications</th>
<th>Before procedure</th>
<th>During procedure</th>
<th>After procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>If patient is taking insulin or oral antihyperglycemics, ask physician if dose should be held or adjusted</td>
<td>If patient is taking insulin or oral antihyperglycemics, ask physician if dose should be held or adjusted</td>
<td>After placement of ablation catheter in (left) side of heart, give heparin per order to maintain ACT &gt;250 s</td>
<td>Administer drugs for nausea and vomiting as needed</td>
</tr>
<tr>
<td>Administer other medications with sips of water unless ordered held</td>
<td>Administer other medications with sips of water unless ordered held</td>
<td>Administer intravenous fluids as ordered</td>
<td>Administer analgesics as needed</td>
</tr>
<tr>
<td>Be sure patient stopped taking warfarin for 4 d and was treated with heparin or enoxaparin (if outpatient)</td>
<td>Be sure patient stopped taking warfarin for 4 d and was treated with heparin or enoxaparin (if outpatient)</td>
<td>Administer heparin or enoxaparin (if outpatient)</td>
<td>Resume administration of pre-procedural medications: warfarin, heparin, antiarrhythmics as ordered</td>
</tr>
<tr>
<td>Be sure last dose of heparin taken at least 4 h before the procedure</td>
<td>Be sure last dose of heparin taken at least 4 h before the procedure</td>
<td>Stop administration of antiarrhythmics (if ordered)</td>
<td>Be sure patient stopped taking warfarin for 4 d and was treated with heparin or enoxaparin (if outpatient)</td>
</tr>
<tr>
<td>Stop administration of antiarrhythmics (if ordered)</td>
<td>Stop administration of antiarrhythmics (if ordered)</td>
<td><strong>Diet</strong></td>
<td>Have patient resume preprocedural diet as tolerated after recovery from sedation</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td>Instruct patient to take nothing by mouth except for medications after midnight or at least 6 h before procedure</td>
<td>Allow activity as tolerated</td>
<td>Keep patient on bed rest with head of bed &lt;30° for 4 h</td>
</tr>
<tr>
<td>Instruct patient to take nothing by mouth</td>
<td>Instruct patient to take nothing by mouth</td>
<td>Keep patient on bed rest</td>
<td>Keep affected extremities immobilized for 4 h</td>
</tr>
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<td></td>
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<td></td>
<td>Have patient walk after 4 h and check groin</td>
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<tr>
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<td></td>
<td></td>
<td><strong>Education of patients and their families</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Health problems related to admission: Explain procedure, placement of sheaths, immobility, ingestion of nothing by mouth, monitoring, and discharge care</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Medications/pain management: Explain that patient will have moderate sedation during procedure, pain management after procedure; provide instructions for use of warfarin/enoxaparin</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Discharge planning</strong></td>
</tr>
<tr>
<td>Notify patient and patient’s family of anticipated length of procedure and potential discharge time</td>
<td>Notify patient and patient’s family of anticipated length of procedure and potential discharge time</td>
<td>Keep patient’s family informed of patient’s status during procedure and need for overnight hospitalization or discharge after 4 h</td>
<td>Review that patient must do no heavy lifting or stair climbing for 24 h to 48 h</td>
</tr>
<tr>
<td>Verify that patient has an escort or a ride home if an outpatient</td>
<td>Verify that patient has an escort or a ride home if an outpatient</td>
<td>Report to the receiving unit: Sheaths: Sites: Removed at: Sedation: Midazolam__mg Fentanyl__µg Bed rest until: Discharged at:</td>
<td>Review when patient may return to work</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Check with physician about driving restrictions</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Review instructions for ICD shocks and when to call 911</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If electrophysiological study inducible for ventricular tachycardia, follow ICD pathway</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Check for follow-up with primary cardiologist for international normalized ratio monitoring if patient is taking warfarin</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Check for follow-up with primary cardiologist for yearly amiodarone monitoring of pulmonary, liver, and thyroid function tests, and eye examination</td>
</tr>
</tbody>
</table>

*Continued*
or more and may involve the endocardium, the myocardium, and even the epicardium.15

Complications
The potential risks and benefits of the procedure are discussed in detail with each patient before the procedure while informed consent is being obtained. Procedure-related mortality rate for ablation of ventricular tachycardia associated with heart disease is 1% to 2.7%.6,9 The risk for major complications, including stroke, transient ischemic attack, myocardial infarction, cardiac perforation requiring treatment, or heart block is 5% to 8%.6,15,16 During follow-up, approximately 10% of the patients die of progressive heart failure.6,17 This risk of death is not unexpected in patients with markedly depressed function of the left ventricle.17 Other risks are those associated with vascular access (2%-4%), including bleeding, infection, hematoma, and vascular injury. Cardiac trauma, infarction, and valvular damage (1%-2%) have been reported.18 The frequency of valvular complications is slightly higher with left-sided ablations in which the retrograde aortic approach is used.19 Thromboembolism, including stroke, systemic embolism, and pulmonary embolism (<1%) are possible.18 Radiofrequency catheter ablation may require extended fluoroscopic exposure, resulting in elevated radiation risk, including skin burns and risk of malignant neoplasms.20 Segal et al21 found 6 major procedural complications (15%) in the 40 patients studied. These included cardiogenic shock after ventricular fibrillation and 5 complications after transseptal puncture, including cerebrovascular accident, hemothorax, and pericardial tamponade. Other complications included transient ischemic attack after a direct-current shock, complete heart block, and a false aneurysm in the femoral artery.21

After the Procedure
Nursing care after ablation to treat ventricular tachycardia involves frequent monitoring of vital signs and groin sites, with checks every 15 minutes for the first hour, then checks twice every 30 minutes, and then checks twice every hour. The patient is transferred to the holding area or inpatient room when the recovery score on the Aldrete scale22 is 8 or greater. A decrease in blood pressure is treated initially with intravenous fluids and may be related to sedation, a vagal response to sheath removal, or hypovolemia. Sustained decreased blood pressure that does not respond to fluids, especially if chest pain occurs is followed up by using emergent echocardiography to rule out pericardial effusion. A second possible complication is bleeding or hematoma at the groin site. Any further bleeding at the groin site requires direct manual pressure for an additional 5 to 10 minutes. Patients must maintain bed rest for at least 4 hours with the head of the bed elevated to no greater than 30º. The urinary catheter is left in place until bed rest restrictions are removed.

A change in level of consciousness, including restlessness and confusion, must always be investigated. An initial change in level of consciousness may be related to sedation, which can be reversed with naloxone or flumazenil. However, continued changes may require computed tomography.
of the head to rule out stroke or intracerebral bleeding.

Results

Studies have indicated an immediate success rate, defined as nonducibility of the target ventricular tachycardia at the end of ablation, of 63% to 93%. O’Callaghan et al found that 5 years after ablation, total mortality was 51%, and probability of freedom from all ventricular tachyarrhythmias was 28%. Segal et al found that of the 57.9% of areas targeted for ablation, 87.2% were successfully ablated. However, only 42.5% of patients remained free from ventricular tachycardia/fibrillation 3 years after ablation. Therefore, immediate procedural success should not be accepted as definitive therapy, and further studies must be done to improve understanding of methods for performing ablations to treat ventricular tachycardia.

Conclusions

Radiofrequency catheter ablation offers potential control of arrhythmia without the adverse effects of antiarrhythmic drugs. To date, applicability had been limited for patients with multiple hemodynamically unstable or unmappable ventricular tachycardias. The development of advanced mapping systems has expanded the array of options for clinicians in the treatment of ventricular tachycardia. Ablation can be lifesaving for patients with incessant ventricular tachycardia and can decrease frequent episodes of ventricular tachycardia that cause an ICD to deliver repeated shocks.

References


CE Test  Test ID C065: Mapping Ventricular Tachycardia

Learning objectives: 1. Discuss the advantages and limitations of radiofrequency ablation as a therapy for patients at high risk of sudden death caused by ventricular arrhythmias  2. Describe appropriate nursing interventions before, during, and after radiofrequency ablation for patients undergoing the procedure 3. Identify the signs and symptoms of common complications of radiofrequency ablation and proper nursing care related to each one

1. Which of the following statements concerning radiofrequency ablation is true?
   a. It is highly effective in patients who have significant structural heart disease.
   b. It is used as an adjunct to treatment with an implantable cardioverter defibrillator in patients with structural heart disease.
   c. It alleviates the need for pharmacological treatment of ventricular tachycardia.
   d. It improves impulse conduction through scarred myocardial pathways.

2. Mapping techniques are aimed at identifying which of the following?
   a. Location of the reentrant circuit
   b. QRS morphology of the ventricular tachycardia
   c. Presence of nonischemic cardiomyopathies
   d. Zones of rapid conduction within the myocardial bundles

3. Administration of intravenous heparin is especially important during which time?
   a. Immediately after removal of the femoral sheath
   b. For at least 24 hours before the radiofrequency ablation procedure
   c. While ablation catheters are in the left side of the heart
   d. Just before delivery of the alternating current to the targeted myocardium

4. How is hypotension after radiofrequency ablation initially treated?
   a. By placing the patient in Trendelenburg position
   b. By administering an intravenous fluid bolus
   c. By administering oxygen
   d. By administering low-dose dopamine

5. What are chest pain and sustained hypotension after radiofrequency ablation indicative of?
   a. Valvular complications
   b. Pulmonary embolism
   c. Pericardial effusion
   d. Bleeding or hematoma at the catheter insertion site

6. Discharge teaching for a patient who has undergone radiofrequency ablation will include which of the following instructions?
   a. Bedrest, except going to the bathroom, for 24 hours
   b. No driving for 48 to 72 hours
   c. Withholding all preprocedure medications until first follow-up appointment with physician
   d. No stair climbing for 24 to 48 hours

7. The Aldrete scale is used to measure which of the following?
   a. The patient's recovery score following the ablation procedure
   b. The level of voltage required to accomplish radiofrequency ablation
   c. The number of radiofrequency lesions required to achieve the desired result
   d. The electrogram amplitude in areas of scarred myocardium

8. Radiofrequency ablation therapy is most successful in treating which of the following?
   a. Supraventricular tachycardia with associated structural heart disease
   b. Ventricular tachycardia associated with hemodynamic instability
   c. Monomorphic ventricular tachycardia arising from multiple sites
   d. Ventricular tachycardia without structural heart disease

9. In addition to monitoring the patient's blood pressure, pulse, oxygen saturation, and cardiac rhythm, which parameter is measured during the radiofrequency ablation procedure?
   a. Carbon dioxide
   b. Arterial pH
   c. Cardiac output
   d. Pulmonary artery wedge pressure

10. Which of the following postprocedure patient conditions must be thoroughly investigated?
    a. Activated clotting time less than 170 seconds
    b. Restlessness and/or confusion
    c. Oxygen saturation of 95% on room air
    d. International normalized ratio = 1.0

11. The target for ablation of scarred tissue causing tachycardia is which of the following?
    a. Ischemic myocyte bundles
    b. Fibrotic areas of the pericardium
    c. Slow conduction zones along infarct borders
    d. Areas of thrombogenic endocardial lesions

12. Which of the following is an example of a newly developed advanced mapping system?
    a. Activation-sequence mapping
    b. Pace mapping
    c. Entrainment mapping
    d. Real-Time Position Management System

13. Which color on a voltage map delineates the areas of dense scar to be targeted for ablation?
    a. Red
    b. Blue
    c. Yellow
    d. Green

14. Preprocedure teaching for a patient who will be undergoing radiofrequency ablation should include which of the following?
    a. Continue all medications as prescribed, especially anticoagulant medications
    b. Discontinue all previous medications after midnight preceding the procedure
    c. Discontinue use of warfarin for 4 days before the procedure
    d. Continue antiarrhythmic medications, but discontinue all others for 12 hours before the procedure

Test answers: Mark only one box for your answer to each question. You may photocopy this form.

1. □ a □ b □ c □ d
2. □ a □ b □ c □ d
3. □ a □ b □ c □ d
4. □ a □ b □ c □ d
5. □ a □ b □ c □ d
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7. □ a □ b □ c □ d
8. □ a □ b □ c □ d
9. □ a □ b □ c □ d
10. □ a □ b □ c □ d
11. □ a □ b □ c □ d
12. □ a □ b □ c □ d
13. □ a □ b □ c □ d
14. □ a □ b □ c □ d

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Mapping Ventricular Tachycardia

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