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Catheter Ablation of Atrial Fibrillation

A review of potential complications and an evidence-based approach to postprocedure nursing care.

OVERVIEW: Catheter ablation of atrial fibrillation is a complex procedure. Although complications are rare and their incidence is decreasing, early recognition and appropriate nursing care can prevent an adverse event from spiraling into a major complication. A thorough understanding of complications associated with the ablation of atrial fibrillation and prompt recognition when they occur will help nurses to minimize the substantial morbidity, mortality, and hospital costs associated with them. This article gives an overview of the procedure, its possible complications, and best practices for nursing care.

Keywords: atrial fibrillation, cardiac arrhythmia, catheter ablation, nursing protocol

Atrial fibrillation is the most common sustained cardiac arrhythmia.[1] Its prevalence increases with age[2]—about 70% of those affected are between the ages of 65 and 85 years[3]—and it's seen in 1.5% to 2% of the general population.

Atrial fibrillation is a supraventricular tachyarrhythmia characterized by disorganized contractions of the atria.[3,4] Diagnosis requires an electrocardiogram (ECG) demonstrating irregular R-R intervals, no distinct P waves, and an atrial cycle length (the interval between two atrial activations) that varies and lasts less than 200 msec.[1] In atrial fibrillation the electrical impulses are fast, chaotic, and uncoordinated, preventing the atria from contracting or pumping the blood into the ventricles. This results in the pooling of blood within the atrial appendage, a small pouch within the atrium, and can lead to clot formation. An embolus forms if part of the clot breaks away. Atrial fibrillation may cause an excess number of electrical impulses to pass through the atrioventricular node in a fast and disorganized manner, leading to an increase in ventricular rate and possibly a ventricular arrhythmia. The loss of atrioventricular synchrony causes a decreased stroke volume (the amount of blood pumped from the left ventricle) and overall cardiac output, leading to symptoms such as light-headedness, fatigue, breathlessness, and chest pain. Atrial fibrillation increases the risk of death, stroke, and congestive heart failure.[2] For the different types and classifications of atrial fibrillation, see Table 2 in "Atrial Fibrillation: Updated Management Guidelines and Nursing Implications," May, at http://bit.ly/1GcwmxI.

The treatment of atrial fibrillation is costly, around $8,700 annually per patient,[5] mostly owing to frequent hospitalizations.[5-7] The costs and associated clinical and social burdens of this challenging condition are likely to increase substantially in the coming years as the population ages.[2,6,7] This is especially true because patients with atrial fibrillation have high rates of cardiovascular comorbidities, such as hypertension, structural heart disease, coronary artery disease, heart failure, cerebrovascular disease, and diabetes.[7,8]

Treatment of atrial fibrillation focuses on controlling heart rate and rhythm and preventing thromboembolism. Heart rate and rhythm can be controlled with either medication or catheter ablation.[3] Antiarrhythmic agents are a noninvasive approach often tried before ablation, especially in older adults. Patients who remain symptomatic despite medication or whose overall cardiac function deteriorates, as occurs with worsening heart failure secondary to atrial

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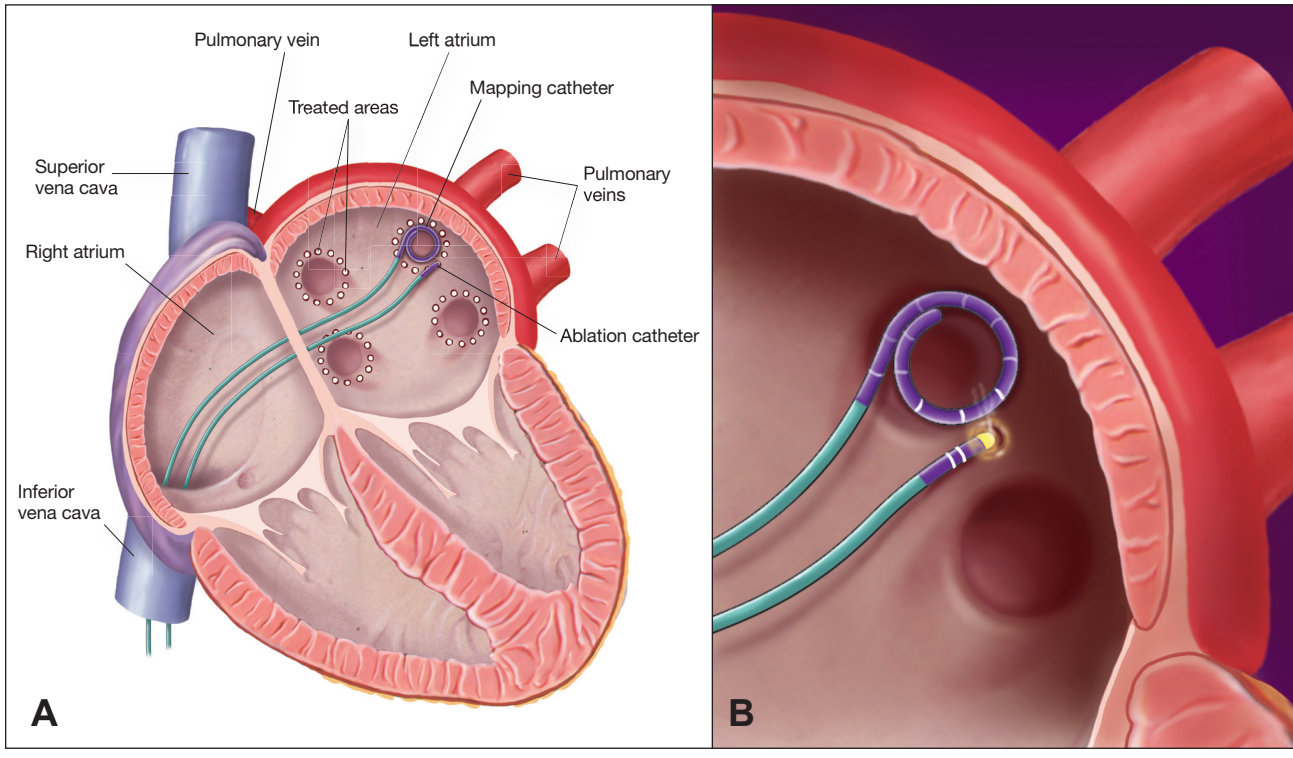

The catheter ablation procedure involves electrical ablation of tissue around the circumference of the pulmonary veins, the most common site for atrial fibrillation triggers (A). Lesions are created through the use of an irrigated radiofrequency ablation catheter (B). Illustration by Anne Rains.

fibrillation, can be treated with pharmacologic or electrical cardioversion, or both, or with catheter ablation.[3]

Whether a patient with atrial fibrillation needs anticoagulation treatment is determined by stroke risk, regardless of whether the rhythm converts and is maintained in sinus rhythm.[3] $CHADS_2$—which stands for congestive heart failure, hypertension, ages 75 years or older, diabetes mellitus, and prior stroke or transient ischemic attack—is a clinical prediction rule for assessing the risk of stroke in patients with nonvalvular atrial fibrillation and without significant aortic or mitral valve disease.[9,10] The results are used to determine the need for anticoagulation therapy; the higher the $CHADS_2$ score, the greater the stroke risk. (See Table 1 for how to calculate the score.[9,10])

According to the recommendations of the 2012 Heart Rhythm Society Task Force, developed in collaboration with several other international medical societies, the primary indication for a catheter ablation procedure is symptomatic atrial fibrillation that doesn't respond to antiarrhythmic medication.[4] But some patients prefer to undergo catheter ablation first: some wish to avoid the adverse effects of medication[4]; others, especially younger patients, wish to avoid decades of drug therapy.[3] Patients need to understand the risks and benefits of different approaches to atrial fibrillation management before deciding to undergo a catheter ablation.[3,4]

Cappato and colleagues conducted a worldwide survey between 2003 and 2006, in which 85 centers reported performing 20,825 catheter ablations on 16,309 patients; 70% of patients who underwent ablation did not require antiarrhythmic agents afterward, and an additional 10% became asymptomatic in the presence of previously ineffective antiarrhythmics.[11] However, each patient had an average of 1.3 catheter ablation procedures to attain these results. The success of the ablation depends on several factors, including the type of atrial fibrillation the patient has and how long she or he has had it. For instance, in this study, ablation for paroxysmal atrial fibrillation had a greater success rate (75%) than ablation for either persistent (65%) or long-lasting (63%) atrial fibrillation.[11]

The goal of catheter ablation is to prevent atrial fibrillation by eliminating or altering the trigger that initiates it.[4] The procedure involves electrical

Table 1. $CHADS_2$ Scoring Table to Estimate Stroke Risk[9, 10]

	$CHADS_2$ Risk Criteria	Points
C	Congestive heart failure	1
H	Hypertension	1
A	Ages 75 years or older	1
D	Diabetes mellitus	1
S	Prior stroke or transient ischemic attack	2

Note: The $CHADS_2$ score is calculated by adding the points that correspond to the patient's conditions. A score of 0 to 1 is low risk; 2 to 3 is moderate risk; and 4, 5, or 6 is high risk.

ablation of the tissue around the circumference of the pulmonary veins, the most common site for atrial fibrillation triggers. Lesions are created through the use of irrigated radiofrequency ablation catheters, which use a saline flush at the catheter tip to reduce excessive heating of the tissue and blood. Electroanatomic mapping systems are used as well; the map is a color-coded, three-dimensional image of the heart chamber showing real-time electrophysiological information that guides the placement of the catheter. The lesions created block the formation of atrial fibrillation waves from the rapidly firing trigger source (in this case, arising in the pulmonary veins); these impulses would otherwise travel in a self-sustaining circular path.[4, 12]

Complications after an ablation procedure for atrial fibrillation are rare but can be serious, and yet there are no universal nursing guidelines for caring for patients who've undergone an ablation procedure. This article provides an overview of the ablation procedure and its associated complications. Nursing care protocols and nursing competencies developed by the Hospital of the University of Pennsylvania outline postprocedural nursing care.

THE CATHETER ABLATION PROCEDURE

Prior to the procedure, the patient will most likely have a transesophageal echocardiogram (TEE), a cardiac magnetic resonance imaging (MRI) scan, or a cardiac computed tomographic (CT) scan.[4, 12] A TEE is performed on patients with atrial fibrillation, regardless of whether they received anticoagulation therapy, to screen for a left atrial thrombus. Routine TEE may not be performed in patients with paroxysmal atrial fibrillation who present in sinus rhythm on admission and have no structural heart disease or risk factors for stroke.[4] A cardiac CT or MRI scan shows the pulmonary veins and left atrium—in particular the anatomic relationship between the left atrium, the esophagus, and adjacent vascular structures.[4, 12]

The cardiac CT or MRI scan is usually done the day before the procedure; the image will be used as a guide to the area to be ablated. Thus, patients are instructed not to eat or drink on the day of admission before these tests are completed. Antiarrhythmic drugs are withheld to ease the induction of atrial fibrillation during the procedure; anticoagulant drugs are continued during the procedure to decrease the risk of stroke.[4]

The ablation procedure takes two to six hours to complete. Patches for ECG, cardiac mapping, and defibrillation are applied, and the patient receives conscious sedation or general anesthesia to minimize pain and movement (these may affect the stability of the catheter inside the heart). A radiopaque esophageal temperature probe and an indwelling urinary catheter are inserted. Venous access is obtained through the right and left femoral veins and sometimes the right internal jugular vein. A radial or femoral artery is used for arterial pressure monitoring during the procedure. An intracardiac echocardiography (ICE) catheter is inserted through a femoral vein to guide catheter manipulation, evaluate tissue contact or lesion morphology, and allow immediate recognition of complications.[13] A specialized catheter is inserted into the femoral vein and positioned in the coronary sinus for recording and pacing.[14, 15]

Fluoroscopy and ICE guide the clinician in making two transseptal punctures. Systemic anticoagulation begins after the first puncture, with a goal activated clotting time (ACT) of 300 to 400 seconds.[4, 15] An open irrigation, deflectable-tip catheter is used for mapping and catheter ablation. The previously taken MRI and CT images are incorporated into a three-dimensional mapping system for guidance as the pulmonary vein is isolated. During the procedure, fluoroscopy and computerized mapping systems track the catheter positions and permit precise delivery of radiofrequency energy.[15]

POTENTIAL COMPLICATIONS

Catheter ablation of atrial fibrillation is a complex intervention, one associated with more major risk factors and complications than catheter ablations performed for other arrhythmias. The risk of complications is high for several reasons: a large area of tissue is ablated, a significant amount of energy is delivered, nearby structures might be injured, and the procedure carries a high risk of a thromboembolic event.[4]

A "major complication" of atrial fibrillation is defined by the 2012 Heart Rhythm Society Task Force as a complication resulting in permanent injury or harm and requiring treatment or hospitalization for more than 48 hours.[4] Bleeding is a major complication if it requires a transfusion or causes a 20% or greater drop in hematocrit levels.[4]

The most common complications reported are vascular injuries, pericardial tamponade, and cerebral thromboembolic events.[11, 16] Cappato and colleagues' 2003–2006 survey of 85 centers that performed over 20,000 catheter ablations revealed a 4.5% rate of

major complications, including cardiac tamponade, cerebral thromboembolic events, pulmonary vein stenosis, phrenic nerve injury, and, very rarely, atrioesophageal fistula.[11] This is a decrease from a complication rate of 6% in an earlier Cappato and colleagues survey (1995–2002), in which data were gathered from 100 centers on 11,762 catheter ablations performed in 9,379 patients.[17] Recent improvements in image mapping systems, irrigated-tip catheters, and periprocedural anticoagulation strategies have improved patient outcomes.[16]

It is important for nurses to know the complications that can occur both during and after catheter ablation as they assess and monitor their patients following the procedure.

Vascular access complications constitute the majority of complications, with an incidence as high as 13%,[4] and include groin hematoma, retroperitoneal bleeding, femoral pseudoaneurysm, and arteriovenous fistula. Strategies to reduce vascular access complications include using a small (21-gauge) needle and ultrasound guidance to obtain vascular access and eliminating the use of femoral arterial access.[14] Use of the femoral artery increases the risk of complications, especially if the puncture is made too far below or above the inguinal ligament and anticoagulation is used.[18]

Vascular complications may result from the number and size of venous sheaths deployed and the insertion of an arterial pressure line with aggressive anticoagulation.[4]

Signs and symptoms include hematomas that appear as an induration at the vascular access site and which can result in hypotension, tachycardia, or a decrease in hemoglobin and hematocrit levels. Retroperitoneal bleeding presents as moderate to severe back or flank pain, hypotension, tachycardia, ecchymosis, abdominal distension, or a decrease in hemoglobin and hematocrit levels. Femoral pseudoaneurysm and arteriovenous fistula can present as a bruit at the access site, or they can be asymptomatic.

Nursing management of hematoma involves applying pressure 1 to 2 cm above the puncture site for arterial access and at the puncture site for venous access. The nurse will also mark the area to evaluate any change in size, administer IV fluids, monitor serial blood cell counts, maintain the patient on bed rest, interrupt anticoagulant and antiplatelet medications if necessary, and administer blood transfusion if indicated. For retroperitoneal bleeding the nurse administers IV fluids and blood products, monitors serial blood cell counts, maintains the patient on bed rest, and stops all anticoagulants. For pseudoaneurysm or arteriovenous fistula the nurse prepares the patient for ultrasound or CT scan of the groin.

Most vascular complications are managed conservatively; however, some require blood product transfusions or surgical intervention. Hematomas and retroperitoneal bleeding usually resolve within a few weeks as the blood is absorbed into the tissue. Severe cases may require surgical evacuation. Pseudoaneurysms and arteriovenous fistulas are usually managed by ultrasound-guided compression or, rarely, surgery.[14] Pseudoaneurysms may require thrombin injection.

Cardiac tamponade is a rare but potentially life-threatening complication characterized by pericardial effusion either during or within 30 days of the procedure.[4, 19] The risk of this complication has been reduced by the routine use of general anesthesia, echocardiography-guided transseptal puncture, relatively low power settings, and ICE.[20] The incidence is between 0.5% and 2%.[12]

Usually caused by intracardiac catheter manipulation and systemic anticoagulation,[4] cardiac tamponade is characterized by a decrease in blood pressure, an increase in heart rate, and pulsus paradoxus. Nursing management involves aggressive IV fluid resuscitation and preparing the patient for pericardiocentesis, the definitive treatment.[4, 19]

The risk of complications from catheter ablation of atrial fibrillation is high because a large area of tissue is ablated, a significant amount of energy is delivered, nearby structures might be injured, and the procedure carries a high risk of a thromboembolic event.

Thromboembolic events typically occur within 48 hours of catheter ablation and usually do not lead to persistent disability.[21] Diagnosis and treatment of these events vary according to the location of the embolus. The high incidence of thromboembolic events following the procedure has led to the use of higher-intensity periprocedural anticoagulation and targets of 2.5 for international normalized ratio (INR) and 350 seconds or more for ACT.[4, 22, 23] The incidence of

Table 2. Post–Catheter Ablation of Atrial Fibrillation Nursing Care Protocol from the Hospital of the University of Pennsylvania

Assessment/Monitoring	Rationale	Treatment
Vital signs		
Assess every • 15 min × 4, then • 30 min × 4, then • hourly × 2	Identify complications early.	• Report symptomatic hypotension or systolic blood pressure < 90 mmHg or any other significant change in vital signs. • Have IV fluids ready to infuse.
Peripheral pulse check		
Distal to access site with vital signs	Assess circulation with and without sheaths.	Report any decrease in pulse.
Vascular access site		
• Sheath will be pulled once ACT is < 180 sec. • Prescriber is responsible for removing sheaths. • During and after sheath removal, o monitor vital signs. o assess for vasovagal episode with severe bradycardia or hypotension, nausea, vomiting, sweating. o assess for blood loss. • Patients are maintained on bed rest 4–6 hrs after vascular access site hemostasis is achieved following sheath removal. • Assess for o bleeding. o bruit. o hematoma.	• ACT results should be within acceptable limits to decrease the risk of bleeding. • Multiple sheaths may be maintained in multiple sites. • Decrease the risk of vascular complications following sheath removal. • Vascular complications are the most common and include o groin hematoma. o retroperitoneal bleeding. o femoral arterial pseudoaneurysm. o femoral arteriovenous fistula.	• Report complications at the vascular access site. • Have IV fluids ready to infuse. • Apply pressure 1–2 cm above the puncture site for arterial access and at the puncture site for venous access, if needed. • Report complications and plan for ultrasound or CT scan.
Neurologic		
• Assess using Glasgow Coma Scale and check extraocular movements with vital signs for the first 5 hrs after the procedure, then every 2 hrs for 12 hrs. • Observe any changes in the patient's o ability to move extremities. o vision. o speech.	Risk of stroke occurs early after the procedure.	• Report changes in neurologic status. • Prepare for CT scan and assessment by the stroke team.
Arrhythmia		
• Monitor for recurrent atrial arrhythmias. • Prepare for an ECG following the procedure and daily thereafter. • Obtain a 12-lead ECG if o atrial fibrillation or flutter recurs. o there is a change in rhythm. o an unusual QT prolongation is suspected.	• Identify ECG changes early. • Transient pericardial inflammation may cause atrial fibrillation shortly after the ablation procedure.	• Report recurrent atrial arrhythmias. • Keep patient NPO pending the treatment plan.

Anticoagulation • Initiate or resume heparin infusion 6 hrs after vascular access site hemostasis is achieved, unless otherwise ordered by the prescriber. • Continue heparin for 24–48 hrs after the procedure. • Give warfarin the evening of the procedure. • Monitor PTT and INR levels.	Atria are often stunned after ablation; postprocedure anticoagulation can prevent thrombus formation.	Adjust medications per prescriber's orders.
Antiarrhythmic medication Initiate or resume as ordered.	Maintain normal sinus rhythm.	Administer per prescriber's orders.
Volume status • Record intake and output. • Assess patient's volume status and the need for diuresis.	Patients often leave the electrophysiology laboratory with excess fluid in their system.	Administer diuretics if prescribed.
Urine output • Remove indwelling urinary catheter at the end of bed rest. • Assess urine for hematuria and gross signs of infection such as dysuria and frequency.	• Early catheter removal decreases infection risk. • Hematuria may develop after the procedure secondary to anticoagulation and catheter insertion.	• Notify the prescriber of hematuria and do not remove the catheter until further directed. • If infection is suspected, notify the prescriber. • If infection is suspected, send urine for analysis and culture and sensitivity testing.
Allergic reaction/anaphylaxis	Unidentified allergy to protamine, latex, or contrast dye	• Notify the prescriber. • Keep the patient NPO pending the treatment plan.
Other complications • Pericardial effusion • Hemorrhage • Heart failure	Complications may occur at any time.	• Notify the prescriber. • Keep the patient NPO pending the treatment plan. • Have IV fluids ready to infuse.

ACT = activated clotting time; CT = computed tomographic; ECG = electrocardiogram; INR = international normalized ratio; NPO = nothing by mouth; PTT = partial thromboplastin time.

stroke or transient ischemic attack after the procedure ranges from 0.2% to 1%.[11, 21, 24]

Thromboembolic complications after the ablation procedure have several possible causes. These include thrombus formation on or within the stationary sheaths,[13] endothelial lesions from the procedure, systemic activation of platelets and of the coagulation system, transseptal puncture with a persistent atrial septal defect, periprocedural cardioversion, and local heating during energy delivery causing thrombus formation on the catheter tip or at the ablation site.[4] Air emboli occurring during the transseptal catheter exchange or disruption of thrombi in the atrium before the procedure may also result in thromboembolic events.

by thermal injury. Improvements in imaging and in identifying the true pulmonary vein ostium have resulted in a dramatic reduction in incidence by preventing the delivery of energy within the pulmonary vein.[4] Its incidence is less than 1%.[25]

Pulmonary vein stenosis may produce no symptoms or one of the following: chest pain, dyspnea, cough, hemoptysis, recurrent lung infections, or symptoms of pulmonary hypertension.[25] Nursing management includes educating the patient on possible symptoms and on the need to report signs and symptoms to the electrophysiology team promptly, rather than assume the problem is respiratory and seek care from a pulmonary or other specialist. Treatment consists of

Because most patients are discharged the day after the procedure, patient teaching should begin before the procedure to allow enough time for patients and family caregivers to understand the instructions.

Such complications must be investigated as with any new neurologic deficit.[21] Nursing management involves alerting the stroke team, keeping the head of the bed flat to increase blood flow to the brain, and preparing the patient for an immediate CT scan of the head. Peripheral arterial embolization may be treated surgically, whereas cerebral embolizations have traditionally been managed conservatively—that is, without surgery and with a focus on addressing the underlying risk factors and optimizing medications.[4]

Silent cerebral embolism is a blood vessel occlusion in the brain that does not result in acute clinical signs or symptoms.[4, 22] The incidence of silent cerebral embolism has been estimated to range between 11% and 41%.[22, 24]

Silent cerebral embolism is asymptomatic; it can result from air introduced during the insertion or exchange of intracardiac sheaths, the dislodgment of thrombi in the heart, or the formation of a thrombus during the ablation itself.[4]

Patients are typically unaware they have suffered a stroke and may not notice any immediate effects of a silent stroke. It can, however, cause subtle signs, such as cognitive impairment. The nurse should notify the team if a silent cerebral embolism is suspected. Treatment involves conservative management, which includes addressing the underlying risk factors and optimizing the use of medications.[4]

Pulmonary vein stenosis is a reduced diameter of the pulmonary vein or pulmonary vein branch caused

angioplasty or stenting to widen the diameter of the pulmonary veins.[25]

Vagal nerve injury, or injury to the vagal anterior esophageal plexus, results in esophageal dysmotility or gastroparesis; its incidence is up to 1%.[5]

Vagal nerve injury occurs when energy is applied to the posterior wall of the left atrium, resulting in acute pyloric spasms and gastroparesis.[4] The patient presents with nausea, vomiting, bloating, weight loss, and abdominal pain within a few hours to a few weeks of the procedure. Nursing management includes preparing the patient for endoscopy, an MRI scan, or a gastric-emptying study. Though most cases improve over time, management options include small and frequent meals, botulinum toxin injection for pyloric spasms, prokinetic agents for gastroparesis, and gastric electrical stimulation with pacing. Surgical procedures such as gastrectomy, gastrostomy, and jejunostomy are considered in the most severe cases.[26]

Atrioesophageal fistula is an infrequent but potentially fatal complication of atrial fibrillation catheter ablation. The closeness of the esophagus to the posterior wall of the left atrium and one or more pulmonary veins increases the risk of injury to the esophagus and nearby nerves, especially with ablation catheters capable of creating large and deep lesions.[4, 27] Preventive strategies include modifying the energy delivered by decreasing the power, moving the ablation catheter frequently on the posterior wall, using alternative energy sources such as cryoenergy, using esophageal

thermal monitoring to identify potentially dangerous heating, and protecting the esophagus with active cooling.[4, 28] The incidence rate is between 0.04 and 0.1%.[4, 11]

A fistula can result from thermal injury, acid reflux, infection from the lumen, and ischemic injury caused by thermal occlusion of the end arterioles.[4] Symptoms appear two to four weeks after the procedure and include fever, chills, or recurrent neurologic events.[4] Esophageal fistula can result in septic shock and death.[4] The nurse prepares the patient for CT or MRI scanning of the esophagus, while maintaining the patient's "nothing by mouth" status. The nurse educates the patient on the warning signs and instructs the patient to contact the provider should symptoms develop.[4] An urgent surgical intervention is required to repair a fistula.

Air embolism results from an inadvertent injection of air into the transseptal sheath. Ruling out an atrioesophageal fistula is necessary when an air embolism is documented after ablation. The downstream migration of the air emboli into the right coronary artery may cause acute inferior ischemia or heart block.[4] Strategies to avoid air embolism include monitoring all infusion lines for air bubbles, removing catheters slowly to minimize suction effects while simultaneously aspirating them, and monitoring patients closely when inserting large sheaths and guide wires.[4, 29] The incidence is quite low, from 0.01% to 0.17%.[30, 31]

Presenting signs include acute inferior ischemia, heart block, altered mental status, or seizures. The nurse administers fluids and supplemental oxygen, places the patient in the Trendelenburg position, and prepares the patient for immediate CT or MRI scanning, as well as for possible hyperbaric oxygen treatment. Treatment is aimed at maximizing cerebral perfusion by administering fluids and supplemental oxygen to increase the rate of nitrogen absorption from air bubbles. The Trendelenburg position or hyperbaric oxygen therapy is used for large bubbles.[4] Pacing and cardiopulmonary resuscitation are initiated if air embolism leads to hypotension or heart block.

Phrenic nerve injury results from direct thermal injury, usually to the right phrenic nerve. The nearness of the right phrenic nerve to the right superior pulmonary vein increases the risk of injury to the phrenic nerve when the lesions from the catheter ablation are close to the pulmonary vein ostium.[4, 32] Early recognition is important to prevention of injury. One preventive method involves superior vena cava pacing of the right phrenic nerve while palpating the abdomen during the ablation procedure. Another method is monitoring the diaphragm during spontaneous breathing using fluoroscopy. At the first sign of injury, energy delivery should be interrupted immediately.[4] Phrenic nerve injury is diagnosed if a sniff test—assessing diaphragm movement as the patient breathes in sharply through the nose—performed under fluoroscopy shows unilateral diaphragm paralysis. After a year, loss of nerve function is thought to be permanent.[4] The prevalence is less than 0.48%.[32] The patient presents with one or more symptoms: dyspnea, hiccups, pleural effusion, cough, atelectasis, or thoracic pain.[32] Nursing management involves providing patient support. Treatment is usually conservative, such as breathing exercises and repeat imaging studies to monitor progress. Phrenic nerve function usually recovers within 12 months.[4]

NURSING CARE

Frequent monitoring of the patient's vital signs, vascular access site, and neurologic status ensures early identification of complications (see Table 2 for a nursing care protocol). Explaining the importance of frequent observation will put the patient at ease and ensure cooperation with instructions.

Fluid overload often results from the continuous infusion of fluids during the procedure; signs include a decrease in oxygen saturation level, shortness of breath, edema, and jugular venous distension. Timely administration of diuretics is paramount, especially in patients with heart failure.

The length of the procedure often causes patients some back discomfort. Placing rolled towels under a patient's knees and waist, applying heat and cold, and managing pain with analgesics are essential to patient comfort. Also, raising the head of the bed to 30° once the venous puncture sites are stable helps to alleviate back pain and makes it safe to eat and drink.[33]

Postanesthesia gastrointestinal discomfort, such as nausea and vomiting, is treated with IV ondansetron (Zofran) administered slowly over two to five minutes. Patients who do not experience gastrointestinal discomfort are usually eager to eat. For toileting needs, logrolling is used to place the patient on a bedpan.

To determine if the patient is ready to come off bed rest, assess vascular access sites for oozing or hematoma and compare vital signs with baseline values.

The patient requires a period of bed rest, usually four hours for all-venous access and six hours for arterial access. To determine if the patient is ready to come off bed rest, assess vascular access sites for oozing or hematoma and compare vital signs with baseline values.

In the absence of femoral hematoma, oozing, or hypertension, and after removing the indwelling urinary

catheter, help the patient to a sitting position. Keep the patient seated for a few minutes to allow the blood pressure to adjust, preventing orthostatic hypotension and possible syncope. Assess the vascular access sites again for oozing or hematoma. If these signs are seen, quickly return the patient to the supine position and apply manual pressure to the vascular access site and notify the prescriber. If there are no complications, help the patient to stand and walk. The day after the procedure a standard echocardiogram is performed with the patient in normal sinus rhythm to assess the left atrium diameter and ventricular ejection fraction.[31]

Discharge process. Because most patients are discharged the day after the procedure, begin patient teaching before the procedure to allow enough time for patients and family caregivers to understand the instructions. These may include, depending on hospital policy, initiating activity, monitoring for arrhythmias, taking antiarrhythmic and anticoagulant medications, caring for vascular access sites, looking for signs of pericarditis (such as fever), and scheduling follow-up appointments.

Activity. Instruct patients not to lift objects heavier than 10 lbs. and to allow plenty of time to recover before resuming work or any stressful activity. They should avoid driving for 48 hours and abstain from submerging in water (bathing or swimming) until puncture sites are healed, which takes about a week, although they may take a shower.

Arrhythmia monitoring. Arranged at the time of discharge, transtelephonic or Holter monitoring for a month assesses for arrhythmias. Atrial fibrillation can recur for up to four weeks after the procedure. The ablation itself can cause pericarditis in the atria, which can trigger episodes of self-limiting atrial fibrillation. Medications should be continued until heart rate is controlled. If postprocedural atrial fibrillation does not resolve with time, a repeat ablation may be considered.

Antiarrhythmic and anticoagulation medications. Antiarrhythmics are continued or sometimes initiated. The decision to discontinue oral anticoagulants is made by the prescriber based on the patient's stroke risk and the success of the ablation procedure. However, patients are commonly discharged on aspirin 325 mg daily for one month, with a later return to the patient's routine aspirin dosage. If warfarin (Coumadin and others) is prescribed, it is continued for at least one month, with an INR goal of 2 to 3. Patients on warfarin must follow up with INR testing as ordered, and nurses must stress the importance of continuing all prescribed medications until transtelephonic or Holter monitoring results are analyzed.

Vascular site care. Minimal ecchymosis, along with minor soreness or a quarter-size bump, is common at each vascular access site. Instruct the patient to contact the clinician who performed the procedure if swelling increases or pain intensifies.

Fever. Instruct the patient to contact the clinician with any unexplained fever higher than 100°F (37.7°C) within three weeks of the ablation. Low-grade fevers of around 99°F (37.2°C) are common immediately after the procedure.

Pericarditis. Explain that the patient may feel minor chest pain due to inflammation or pericarditis for a week after the ablation. Breathing deeply or leaning forward exacerbates pericarditis-associated pain; however, this pain is generally not a concern. Instruct the patient to notify the clinician if pain doesn't resolve within a week or gets worse.

Atrial fibrillation can recur for up to four weeks after the procedure. Medications should be continued until heart rate is controlled. If postprocedural atrial fibrillation does not resolve with time, a repeat ablation should be considered.

Abnormal symptoms. Tell the patient the symptoms that require immediate medical attention: shortness of breath; chest pain not associated with pericarditis; severe palpitations; fainting or feeling faint; signs of a stroke such as numbness, weakness, slurred speech, or vision changes; and any other symptom of concern.

A follow-up appointment is scheduled for four to six weeks after discharge at which the electrophysiologist will assess function, evaluate symptoms, and start weaning medications, if appropriate. A follow-up echocardiogram is scheduled prior to the appointment to assess cardiac function.

Discharge time out. Preparing the patient for discharge includes making sure the discharge paperwork is complete and correct. Performing a discharge time out, with the prescriber and the pharmacist,

Table 3. Post–Catheter Ablation of Atrial Fibrillation Nursing Competency from the Hospital of the University of Pennsylvania

Performance Criteria	Performed	Not Performed
1. Perform hand hygiene before patient contact.	☐	☐
2. Verify the correct patient using two identifiers per organization policy.	☐	☐
3. Review the patient's medical history, and understand the reason for the catheter ablation of atrial fibrillation.	☐	☐
4. Assess the patient's cardiovascular, hemodynamic, peripheral vascular, and neurovascular status.	☐	☐
5. Assess the patient's rhythm.	☐	☐
6. Obtain postprocedural 12-lead electrocardiogram.	☐	☐
7. Monitor electrocardiogram for • QT interval prolongation. • atrial fibrillation or flutter. • ventricular tachycardia. • other arrhythmias.	☐	☐
8. Describe the parameters for hemodynamic stability. • List indications for changes in patient's hemodynamic stability and when to notify the prescriber.	☐	☐
9. Check patient's vital signs, vascular access site, and pulse at appropriate intervals. • List indications for changes in patient's condition and when to notify the prescriber.	☐	☐
10. Assess patient's neurologic status. • List indications for changes in patient's condition and when to notify the prescriber.	☐	☐
11. Assess patient's pain level or discomfort. • List indications for when to notify the prescriber.	☐	☐
12. Assess patient's fluid volume status.	☐	☐
13. Record and monitor intake and output.	☐	☐
14. Describe vascular access site management and nursing care.	☐	☐
15. Explain to the patient postprocedure safety instructions. • Hold pressure at vascular access site when coughing, sneezing, or vomiting.	☐	☐
16. Explain to the patient the limitations of positioning, the need for bed rest, and strategies to remain comfortable.	☐	☐
17. Identify the anticoagulation therapies ordered by the prescriber. • Heparin infusion is restarted 6 hrs after sheath removal. • Heparin is continued for 24–48 hrs. • Warfarin is dosed the night of the procedure.	☐	☐
18. Describe indications for removal of indwelling urinary catheter. • Monitor urine for signs and symptoms of hematuria and infection. • If a urinary tract infection is suspected, send specimens for both urinalysis and culture and sensitivity. • List indications for when to notify the prescriber.	☐	☐
19. List five signs and symptoms of complications related to catheter ablation of atrial fibrillation and the associated nursing action.	☐	☐
20. Explain management of allergic reaction or anaphylaxis. • List indications for when to notify the prescriber.	☐	☐
21. Communicate to the prescriber any patient-related postprocedure issues or concerns.	☐	☐
22. Document the patient's response to the catheter ablation procedure. Include your assessment and interventions.	☐	☐
23. Review with the patient what is expected after discharge.	☐	☐

double-checks prescribed medications and other orders to ensure a safe transition home.

NURSING COMPETENCY

The success of catheter ablation for atrial fibrillation depends on nurses who are familiar with indications for the procedure, pre- and postprocedure monitoring, possible complications, and discharge teaching, and who understand the care of patients undergoing this procedure. Owing to the potential for postoperative complications, nurses at the Hospital of the University of Pennsylvania have developed a skills checklist to standardize nursing competency based on the nursing care protocol. Table 3 summarizes the specific skills required. ▼

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