CARDIAC PACING , Pace maker and Nursing Care Plan

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CARDIAC PACING

A cardiac pacemaker is an electronic device that delivers direct electrical stimulation to stimulate the myocardium to depolarize, initiating a mechanical contraction. The pacemaker initiates and maintains the heart rate when the heart’s natural pacemaker is unable to do so. Pacemakers can be used to correct bradycardias, tachycardias, sick sinus syndrome, and second- and third-degree heart blocks, and for prophylaxis. Pacing may be accomplished through a permanent implantable system, a temporary system with an external pulse generator and percutaneously threaded leads, or a transcutaneous external system with electrode pads placed over the chest.

Clinical Indications

•Symptomatic bradydysrhythmias

•Symptomatic heart block •Mobitz II second-degree heart block

•Complete heart block

•Bifascicular and trifascicular bundle branch blocks

•Prophylaxis •After acute MI: dysrhythmia and conduction defects

•Before or after cardiac surgery

•During diagnostic testing •Cardiac catheterization

•EPS

•Percutaneous transluminal coronary angioplasty (PTCA)

•Stress testing

•Before permanent pacing

•Tachydysrhythmias; to break rapid rhythm disturbances •Supraventricular tachycardia

•Ventricular tachycardia

Types of Pacing

Permanent Pacemakers

•Used to treat chronic heart conditions; surgically placed, utilizing a local anesthetic, the leads are placed transvenously in the appropriate chamber of the heart and then anchored to the endocardium.

•The pulse generator is placed in a surgically made pocket in subcutaneous tissue under the clavicle.

•Once placed and programmed it can be adjusted externally as needed.

Temporary Pacemakers

•Temporary pacemakers are usually placed during an emergency, such as when a patient demonstrates signs of decreased CO until the temporary condition is resolved.

•Indicated for patients with high-grade AV blocks, bradycardia, or low CO. They serve as a bridge until the patient becomes stable enough for placement of a permanent pacemaker.

•Can be placed transvenously, epicardially, transcutaneously, and transthoracically. •Transvenous pacemakers are inserted transvenously (into a vein, usually the subclavian, internal jugular, antecubital, or femoral) under fluoroscopy into the right ventricle or right atrium, or both chambers for dual-chamber pacing, and then attached to an external pulse generator.

•Epicardial pacemaker wires are attached to the endocardium of the heart, brought out through a surgical incision onto the chest, connected to an external pulse generator, and are commonly used when a patient is undergoing cardiac surgery.

•In transcutaneous pacemakers, noninvasive electrodes are placed either anterior-posterior (anterior chest wall right of the upper sternum below the clavicle and to the back of the patient) or anterior-apex (left of the left nipple with the center of the electrode in the midaxillary line), and electrical impulses flow through the electrodes and subcutaneous skin to the heart.

•The transthoracic pacemaker is a type of temporary pacemaker that is placed only in an emergency via a long needle, using a subxiphoid approach. The pacer wire is then placed directly into the right ventricle.

Biventricular Pacemakers

•Biventricular pacemakers are also referred to as cardiac resynchronization therapy.

•Biventricular pacing is used to treat moderate to severe heart failure as a result of left ventricular dyssynchrony.

•Intraventricular conduction defects result in an uncoordinated contraction of the left and right ventricle, which causes a wide QRS complex and is associated with worsening heart failure and increased mortality.

•Biventricular pacemakers utilize three leads (one in the right atrium, one in the right ventricle, and one in the left ventricle) to coordinate ventricular contraction and improve CO.

•Biventricular pacemakers can incorporate implantable cardiac defibrillators or be used alone.

PROCEDURE GUIDELINES

Transcutaneous Cardiac Pacing

EQUIPMENT

•Disposable electrode pads

•External pacing module

•Resuscitative equipment

Procedure :

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Pacemaker Design

Pulse Generator

Contains the circuitry and batteries to generate the electrical signal

•The pulse generator in a permanent pacing system is encapsulated in a metal can, which protects the generator from electromagnetic interferences (EMIs).

•A temporary pacing system generator is contained in a small box with dials for programming . The external box is attached to the patient with Velcro straps. •Transcutaneous external pacing systems house the generator in a piece of equipment similar to an ECG portable monitor. Dials for programming the unit and ECG monitoring are contained in the device.

•Electromechanical interference is more likely to occur with temporary systems.

•Temporary pacing systems use batteries, which need replacement based on use of device. The transcutaneous system has rechargeable battery circuitry.

•Permanent pacing systems use reliable power sources, such as lithium or nuclear batteries. Lithium batteries have a projected life span of 8 to 12 years, whereas nuclear power sources, although used infrequently, offer a 20-year projected life span.

Pacemaker Lead

Transmits the electrical signal from the pulse generator to the heart. One or two leads may be placed in the heart.

•Single-chamber pacemaker. •Single-chamber pacemakers have one lead (unipolar lead) in either the atrial or ventricular chamber.

•Electrical current moves from the pulse generator through the leadwire to the negative pole, which stimulates heart contraction; the electrical impulse then returns to the pulse generator’s metal surface (the positive pole) to complete the circuit.

•The sensing and pacing capabilities of the pacemaker are confined to the chamber where the lead is placed.

•A unipolar system better senses intrinsic cardiac signals, but is more likely to be affected by electromechanical interference.

•Unipolar leads produce a large spike on the ECG.

•Dual-chamber pacemaker. •A dual-chamber‌ pacemaker has two (bipolar) leads.

•One lead is in the atrium, and the other lead is located in the ventricle.

•In bipolar pacing electrical current flows from the pulse generator through the leadwire to the negative pole at the tip of the lead, the heart is stimulated to contract, and then the electrical impulse travels back the positive lead to complete the circuit.

•Pacing and sensing can occur in both heart chambers, closely mimicking normal heart function (physiologic pacing).

•Bipolar systems are less affected by electromechanical interference.

•Bipolar leads produce a small, almost invisible spike.

•Pacemaker leads may be threaded through a vein into the right atrium and/or right ventricle (endocardial/transvenous approach) or introduced by direct penetration of the chest wall and attached to the left ventricle or right atrium

•Fixation devices located at the end of the pacemaker lead allow for secure attachment of the lead to the heart, reducing the possibility of lead dislodgement.

•Temporary leads protrude from the incision and are connected to the external pulse generator. Permanent leads are connected to the pulse generator implanted underneath the skin (epicardial/transthoracic approach).

Pacemaker Function

Cardiac pacing refers to the ability of the pacemaker to stimulate either the atrium, the ventricle, or both heart chambers in sequence and initiate electrical depolarization and cardiac contraction. Cardiac pacing is evidenced on the ECG by the presence of a spike or pacing artifact.

Pacing Functions

•Atrial pacingdirect stimulation of the right atrium producing a spike‌ on the ECG preceding a P wave.

•Ventricular pacing direct stimulation of the right or left ventricle producing a spike on the ECG preceding a QRS complex.

•AV pacing direct stimulation of the right atrium and either ventricle in sequence; mimics normal cardiac conduction, allowing the atria to contract before the ventricles. (Atrial kick received by the ventricles allows for an increase in CO.)

Sensing Functions

Cardiac pacemakers have the ability to see intrinsic cardiac activity when it occurs (sensing).

•Demand ability to sense intrinsic cardiac activity and deliver a pacing stimulus only if the heart rate falls below a preset rate limit.

•Fixed no ability to sense‌ intrinsic cardiac activity; the pacemaker can’t synchronize‌ with the heart’s natural activity and consistently delivers a pacing stimulus at a preset rate.

•Triggered ability to deliver pacing stimuli in response to sensing‌ a cardiac event. •Sees atrial activity (P waves) and delivers a pacing spike to the ventricle after an appropriate delay (usually 0.16 second, similar to PR interval).

•Maintains AV synchrony and increases heart rate based on increases in the body demands that occur with exercise or during stress.

•Physiologic ‌ sensors are being developed as alternatives to trigger‌ a ventricular response, because many patients have atrial dysfunction.

•Sensor-driven‌ rate-responsive pacemakers do not sense atrial activity; a triggered ventricular beat occurs when the pacemaker senses either increases in muscle activity, temperature, oxygen utilization, or changes in blood pH.

Capture Function

•The pacemaker’s ability to generate a response from the heart (contraction) after electrical stimulation is referred to as capture. Capture is determined by the strength of the electrical stimulus, measured in milliamperes (mA), the amount of time the stimulus is applied to the heart (pulse width), and by contact of the distal tip of the pacing lead to healthy myocardial tissue. •Electrical‌ capture is indicated by a P wave or QRS following and corresponding to a pacemaker spike.

•Mechanical‌ capture of the ventricles is determined by a palpable pulse corresponding to the electrical event.

Pacemaker Codes

The Intersociety Commission for Heart Disease (ICHD) has established a five-letter code (1984) to describe the normal functioning of today’s sophisticated pacemakers. Each letter indicates the particular characteristic of the pacer (see Table 12-2, page 352).

TABLE 12-2 Five Letter Code for Pacemakers

LETTER OR POSITION CHARACTERISTIC CODE KEY

I Chamber paced

(Where is the pacing taking place?) V = Ventricle

A = Atrium

D = Dual (Both atrium and ventricle)

O = None

II Chamber sensed

(Which chamber is being sensed?) V = Ventricle

A = Atrium

D = Dual (Both atrium and ventricle)

O = None

III Mode of response

(Response to the sensed events) T = Triggers pacing

I = Inhibits firing in response to a sensed intrinsic event

D = Dual (triggers and inhibits at the same time)

O = None; asynchronous pacemaker

IV Programmability

(Program functions) P = Single programmability

M = Multiple programmability

C = Communication function (telemetry)

O = Absence of rate modulation or programmability

V Antitachyarrhythmia function P = Overdrive pacing

S = Shock intervention for cardioversion or defibrillation

D = Dual (Pacing and shocking capabilities)

O = Absence of pacing and shocking capabilities

Nursing Assessment and Preprocedure Care

•Assess patient’s knowledge level of procedure.

•Instruct patient that he may have nothing by mouth before the procedure.

•Facilitate I.V. line insertion.

•Explain to patient that pacemaker insertion will be performed in an operating or special procedures room with fluoroscope and continuous ECG monitoring.

•Describe local anesthetic that will be used to minimize discomfort; sedation.

•Explain to patient that pacemaker (if permanent) will be placed under the skin in (usually) the left upper chest.

•The incision will be closed with suture or staples.

Nursing Diagnoses

•Decreased Cardiac Output related to potential pacemaker malfunction and dysrhythmias

•Risk for Injury related to pneumothorax, hemothorax, bleeding, microshock, and accidental malfunction

•Risk for Infection related to surgical implantation of pacemaker generator and/or leads

•Anxiety related to pacemaker insertion, fear of death, lack of knowledge, and role change

•Impaired Physical Mobility related to imposed restrictions of arm movement and bed rest

•Acute Pain related to surgical incision and transcutaneous external pacing stimuli

•Disturbed Body Image related to pacemaker implantation

Nursing Interventions

Maintaining Adequate Cardiac Output

•Record the following information after insertion of the pacemaker: •Pacemaker manufacturer, model, and lead type

•Operating mode (based on ICHD code)

•Programmed settings: lower rate limit; upper rate limit; AV delay; pacing thresholds

•Patient’s underlying rhythm

•Patient’s response to procedure

•Attach ECG electrodes for continuous monitoring of heart rate and rhythm. •Set alarm limits 5 beats below lower rate limit and 5 to 10 beats above upper rate limits (ensures immediate detection of pacemaker malfunction (or failure).

•Keep alarms on at all times.

•Analyze rhythm strips per protocol and as necessary. •Identify presence or absence of pacing artifact.

•Differentiate paced P waves and paced QRS complexes from spontaneous beats.

•Measure AV delay (if pacemaker has dual chamber functions).

•Determine the paced rate.

•Analyze the paced rhythm for presence and consistency of capture (every pacing spike is followed by atrial and/or ventricular depolarization).

•Analyze the rhythm for presence and consistency of proper sensing. (After a spontaneous beat, the pacemaker should not fire unless the interval between the spontaneous beat and the paced beat equals the lower pacing rate and/or the paced beat follows the programmed AV delay).

•Monitor vital signs as per facility protocol, and as necessary.

•Monitor urine output and level of consciousnessâ€”ensures adequate cardiac output achieved with paced rhythm.

•Observe for dysrhythmias (ventricular ectopic activity can occur because of irritation of ventricular wall by leadwire). •Monitor for competitive rhythms, such as runs of atrial fibrillation or flutter, accelerated junctional or idioventricular or ventricular tachycardia.

•Report dysrhythmias.

•Administer antidysrhythmic therapy as directed.

•Obtain 12-lead ECG, as ordered.

clip\_image001NURSING ALERT

Transport patient to other parts of facility with portable ECG monitoring and nurse. Patients with temporary pacemakers should never be placed in unmonitored areas.

Avoiding Injury

•Note that a postinsertion chest X-ray has been taken to ensure correct leadwire position and that no fluid is in lungs.

•Monitor for signs and symptoms of hemothoraxâ€”inadvertent punctures of the subclavian vein or artery; can cause fatal hemorrhage; observe for diaphoresis, hypotension, and restlessness; immediate surgical intervention may be necessary.

•Monitor for signs and symptoms of pneumothoraxâ€”inadvertent puncture of the lung; observe for acute onset of dyspnea, cyanosis, chest pain, absent breath sounds over involved lung, acute anxiety, hypotension. Prepare for chest tube insertion.

•Evaluate continually for evidence of bleeding. •Check incision site frequently for bleeding.

•Apply manual pressure and pressure dressing to control bleeding.

•Palpate for pulses distal to insertion site. (Swelling of tissues from bleeding may impede arterial flow.)

•Monitor for evidence of lead migration and perforation of heart. •Observe for muscle twitching and/or hiccups (may indicate chest wall or diaphragmatic pacing).

•Evaluate patient’s complaints of chest pain (may indicate perforation of pericardial sac).

•Auscultate for pericardial friction rub.

•Observe for signs and symptoms of cardiac tamponade: distant heart sounds, distended neck veins, pulsus paradoxus.

•Provide an electrically safe environment for patient. Stray electrical current can enter the heart through temporary pacemaker lead system and induce dysrhythmias. •Protect exposed parts of electrode lead terminal in temporary pacing systems with a rubber glove. (Newer external generators have the lead terminals enclosed in a case; a rubber glove is not necessary.)

•Wear rubber gloves when touching temporary pacing leads. (Static electricity from your hands can enter the patient’s body through the lead system.)

•Make sure all equipment is grounded with three-prong plugs inserted into a proper outlet; biomedical engineer should routinely check room to ensure safe environment.

•Temporary epicardial pacing wires (most common after cardiac surgery) should have the terminal needles protected by a plastic tube; place tube in rubber glove to protect it from fluids or electrical current.

•Be aware of hazards in the facility that can interfere with pacemaker function or cause pacemaker failure and permanent pacemaker damage. •Avoid use of electric razors.

•Avoid direct placement of defibrillator paddles over pacemaker generator; anterior placement of paddles should be 4 to 5 inches (10 to 12.5 cm) away from pacemaker; always evaluate pacemaker function after defibrillation.

•Electrocautery devices and transcutaneous electrical stimulator (TENS) units pose a risk.

•Patients with permanent pacemakers should never be exposed to MRI because the strength of the magnetic field may alter or erase pacemaker program memory.

•Caution must be used if patient will receive radiation therapy; the pacemaker should be repositioned if the unit lies directly in the radiation field.

•Prevent accidental pacemaker malfunctions. •Use clear plastic covering over external temporary generators at all times (eliminates potential manipulation of programmed settings).

•Secure temporary pacemaker generator to patient’s chest or waist; never hang it on an I.V. pole.

•Transfer of patient from bed to stretcher should only be attempted with an adequate number of personnel, so that patient can remain passive; caution personnel to avoid underarm lifts.

•Place a sign over patient’s bed alerting personnel to presence of temporary pacemaker.

•Evaluate transcutaneous pacing electrodes every 2 hours for secure contact to chest wall; change electrode pads as directed or if patient is diaphoretic.

Note: Transcutaneous pacing should not be used continuously for more than 2 hours.

•Monitor for electrolyte imbalances, hypoxia, and myocardial ischemia. (The amount of energy the pacemaker needs to stimulate depolarization may need adjustment if any of these are present.)

Preventing Infection

•Take temperature every 4 hours; report elevations. (Suspect pacemaker system for infection source if temperature elevation occurs.)

•Observe incision site for signs and symptoms of local infection: redness, purulent drainage, warmth, soreness.

•Be alert to manifestations of bacteremia. (Patients with endocardial leads are at risk for endocarditis; see page 400.)

•Clean incision site as directed, using sterile technique.

•Monitor vein through which the pacing leadwire was placed for evidence of phlebitis.

•Evaluate patient’s complaints of increasing tenderness and discomfort at incision site.

•Administer antibiotic therapy as prescribed.

Relieving Anxiety

•Offer careful explanations regarding anticipated procedures and treatments, and answer the patient’s questions with concise explanations.

•Encourage patient to use coping mechanisms to overcome anxietiesâ€”talking, crying, and walking.

•Encourage patient to accept responsibility for care. •Review care plan with patient.

•Encourage patient to make decisions regarding a daily schedule of self-care activities.

•Engage patient in goal setting. Establish with patient priorities of care and time frames to accomplish goals up until discharge.

•Monitor for unwarranted fears expressed by patient (commonly, pacemaker failure), and provide explanations to alleviate fear. Explain to patient life expectancy of batteries and the measures taken to check for failure.

Minimizing the Effects of Immobility

•Explain the purpose of bed rest (24 to 48 hours) and immobilization of extremity nearest to permanent or temporary pacemaker lead implant (allows stabilization of lead in heart and prevents lead dislodgement).

•Encourage patient to take deep breaths frequently each hourâ€”promotes pulmonary function; caution against vigorous coughing (lead dislodgement may occur).

•Instruct patient in dorsiflexion exercises of ankles and tightening of calf muscles. This promotes venous return and prevents venous stasis. Exercises should be done hourly.

•Restrict movement of affected extremity. •Place arm nearest to permanent pacemaker implant in sling as directed; extremity with temporary pacing wire should be immobilized and kept straight as prescribed.

•Instruct patient to gradually resume range of motion (ROM) of extremity as directed (usually 24 hours for permanent implants); avoid over-the-head motions for approximately 5 days.

•Evaluate patient’s arm movements to ensure normal ROM progression; assist patient with passive ROM of extremity as necessary (prevents development of shoulder stiffness caused by prolonged joint immobility); consult physical therapy as directed if stiffness and pain occur.

•Assist patient with activities of daily living (ADLs) as appropriate.

Relieving Pain

•Prepare patient for discomfort he may experience after pacemaker implant or initiation of transcutaneous pacing. •Explain to patient that incisional pain will occur after procedure; pain will subside after the first week, but he may have some soreness for up to 4 weeks.

•Explain to patient the potential for discomfort during transcutaneous pacing; assure patient that the lowest energy possible will be used and analgesics will be given.

•Administer analgesics as directed; attempt to coincide peak analgesic effect with performance of ROM exercises and ADLs.

•Offer back rubs to promote relaxation.

•Provide patient with diversional activities.

•Evaluate effectiveness of pain-relieving modalities.

Maintaining a Positive Body Image

•Encourage patient to express concerns regarding self-image and pacer implant.

•Reassure patient that sexual activity and modes of dressing will not be altered by pacemaker implantation.

•Offer patient the opportunity to talk to others who have had a pacemaker implantation.

•Encourage spouse or significant other of patient to discuss concerns of self-image with patient.

Patient Education and Health Maintenance

Anatomy and Physiology of the Heart

Use diagrams to identify heart structure, conduction system, area where pacemaker is inserted, and why the pacemaker is needed.

Pacemaker Function

•Give patient the manufacturer’s instructions (for particular pacemaker), and help familiarize patient with pacemaker.

•If available, give patient a pacemaker to hold, and identify unique features of patient’s pacemaker; or show patient picture of pacemaker.

•Explain to patient the purpose and function of the component parts of the pacemaker: generator and lead system.

Activity

•Reassure patient that normal activities will be able to be resumed.

•Explain to patient that it takes about 2 months to develop full ROM of arm (fibrosis occurs around the lead and stabilizes it in heart).

•Specific instructions include: •Instruct patient not to lift items over 3 lb (1.4 kg) or perform difficult arm maneuvers.

•Caution patient against excessive stretching or bending exercises.

•Avoid contact sports, tennis, golfing, bowling, and yard work until resumption of these activities is permitted by physician.

•Caution patient not to fire a rifle with it resting over pacemaker implant.

•Sexual activity may be resumed when desired.

•Instruct patient to gauge activities according to sensations of moderate pain in arm or site of implant and stretching sensation in and around implant site.

Pacemaker Failure

•Teach patient to check own pulse rate at least every week for 1 full minute at rest to be sure that preset rate remains constant. (Patients may check pulse daily to ensure all is well and promote a sense of control.)

•Teach the patient to: •Report immediately slowing of pulse lower than set rate, or greater than 100.

•Report signs and symptom of dizziness, fainting, palpitation, prolonged hiccups, and chest pain to health care provider immediately. These signs are indicative of pacemaker failure.

•Take pulse while these feelings are being experienced.

•Encourage patient to wear identification bracelet and carry pacemaker identification card that lists pacemaker type, rate, health care provider’s name, and facility where the pacemaker was inserted; encourage significant other to keep a card with patient’s pacemaker information so someone else will have it.

Electromagnetic Interference

•Advise patient that improvements in pacemaker design have reduced problems of EMI.

•Caution patient that EMI could interfere with pacemaker function. •Inappropriate inhibition or triggering of pacemaker stimuli causing light-headedness, syncope, or death.

•Atrial oversensing may cause inappropriate pacemaker acceleration and can cause palpitations, hypotension, or angina in patients.

•Rapid pacing can also result in ventricular fibrillation.

•Reversion to a synchronous pacing mode. A common response to transient reversion is asynchrony pacing, which can cause irregular heartbeats and/or a decrease in CO, and which may stimulate ventricular tachyarrthymias.

•Reprogramming of the pacemaker or permanent damage to the pacemaker’s circuitry or the electrode-tissue interface are less frequent in occurrence.

•Explain that high-energy radar, television and radio transmitters, industrial arc welders, electrocautery equipment, TENS, large motors (cars, boats), oversized magnets (MRI equipment found in hospitals, junkyards where magnets lift cars), ultrasonic dental cleaning equipment, and electric razors may affect pacemaker function.

•Teach patient to move 4 to 6 feet (4 to 6 m) away from source and check pulse if dizziness or sensations of a fast heart rate occur. Pulse should return to normal.

•Reassure patient that cell phones were predominately analog but have shifted to mostly digital technology, decreasing interactions with pacemakers. It is unlikely that normal cell phone use will result in deleterious interactions with pacemakers. Currently, most pacemakers are equipped with internal filters that prevent interaction with cell phones when used in the presence of analog cell phones.

•Tell patient that antitheft devices and airport security alarms may affect pacemaker function, and trigger the security alarm. Patient should show medical identification card if the alarm is triggered. •Electronic article surveillance (EAS) devices, such as antitheft devices and antishoplifting gates, emit an electromagnetic field that interacts with a tag in an unpurchased item while a customer walks through a gate.

•Acoustomagnetic EAS devices in some studies have resulted in temporary atrial tracking, asynchronous pacing, and single-beat inhibition.

•Hand-held and walk-through metal detectors are relatively safe for patients who have implanted devices, but they will set off alarms.

•Instruct patient to show pacemaker identification card.

•Tell patient that household and kitchen appliances will not affect pacemaker function. Microwave ovens are no longer a threat to pacemaker operation (old warning signs may still be near microwave ovens).

Care of Pacemaker Site

•Advise patient to wear loose-fitting clothing around the area of pacemaker implantation until it has healed.

•Watch for signs and symptoms of infection around generator and leadsâ€”fever, heat, pain, and skin breakdown at implant site.

•Advise patient to keep incision clean and dry. Encourage tub baths rather than showers for the first 10 days after pacemaker implantation. •Instruct patient not to scrub incision site or clean site with bath water.

•Teach patient to clean incision site with antiseptic as directed.

•Explain to patient that healing will take approximately 3 months. •Instruct patient to maintain a well-balanced diet to promote healing.

•Inform patient that there is no increased risk of endocarditis with dental cleaning or procedures, so antibiotic prophylaxis is not necessary.

clip\_image002GERONTOLOGIC ALERT

Elderly patients may experience delayed wound healing because of poor nutritional status. Evaluate nutritional intake carefully, and offer a balanced diet to ensure proper healing.

Follow-Up

•Make sure that the patient has a copy of ECG tracing (according to facility policy) for future comparisons. Encourage patient to have regular pacemaker check-up for monitoring function and integrity of pacemaker.

•Inform patient that transtelephonic evaluation of implanted cardiac pacemakers for battery and electrode failure is available.

•Review medications with patient before discharge.

•Inform patient that the pulse generator will have to be surgically removed for various reasons (eg, battery depletion) and replaced; improved power sources and circuitry make reoperation less frequent. •Relatively simple procedure performed under local anesthesia.

Evaluation: Expected Outcomes

•Vital signs stable; pacing spikes rated on ECG tracing

•Breath sounds noted throughout; respirations unlabored

•Incision without drainage

•Asks questions and participates in care

•Exercises in bed; arm remains immobilized

•Reports pain relief

•Verbalizes acceptance of pacemaker