Epicardial Pacing and Pacing Wire Care on Cardiac Wards

Site Applicability

SPH – Cardiac Inpatient Units 5A, 5B

Practice Level

Basic Skill: Pacing wire Insulation and Post Pacing wire removal care are basic skills and do not require the registered nurse to complete specialized education.

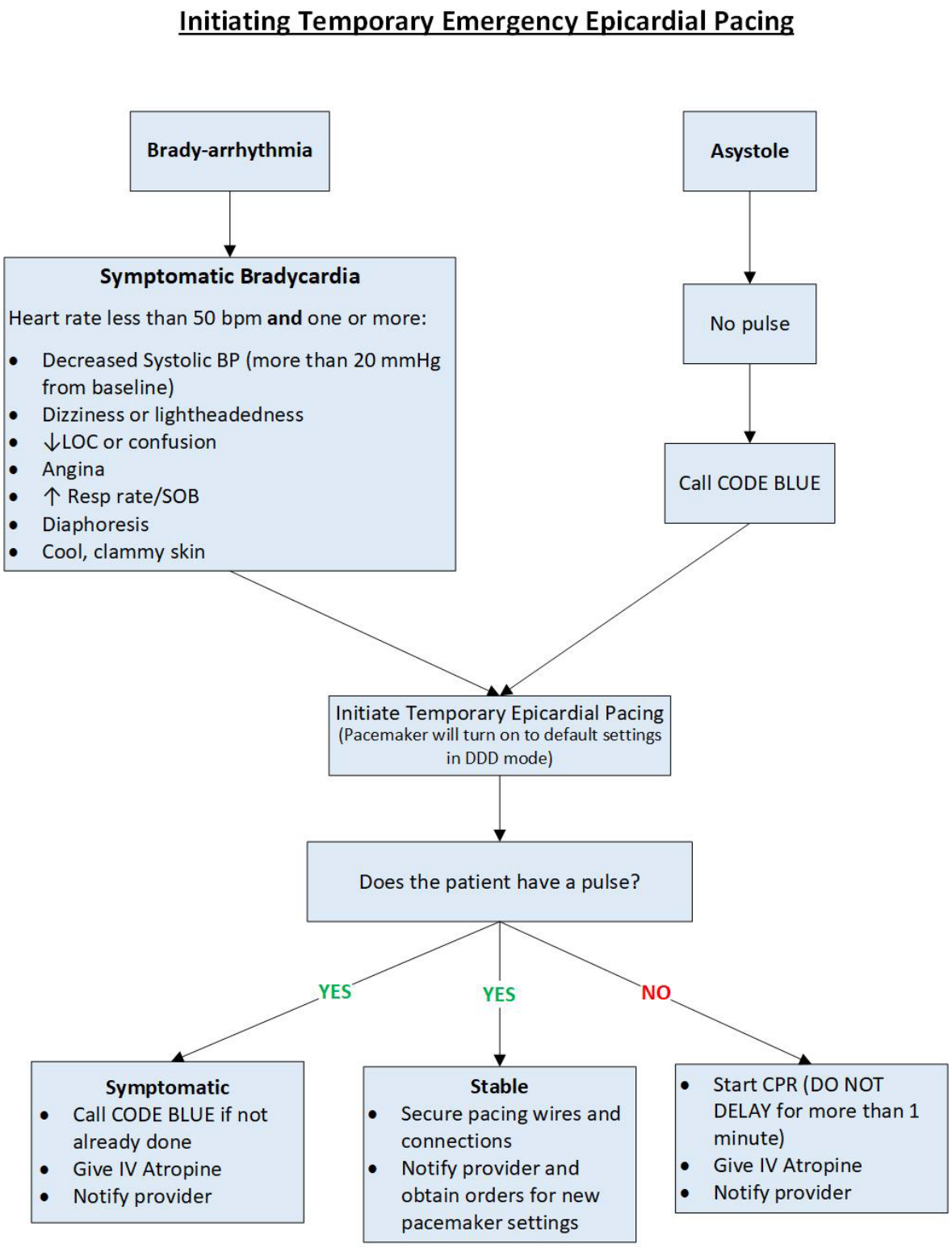
Specialized Skill: Temporary epicardial pacing
Registered nurses who have received epicardial pacing education in the following:

- Connecting/disconnecting pacing wire to/from pulse generator
- Emergency initiation of temporary pacing via epicardial wires
- Trouble-shooting pacing complications

Requirements

1. All temporary epicardial paced patients on 5B must be on Class I cardiac monitoring and may only leave the ward escorted by a RN trained in care and management of temporary epicardial pacing.
2. The patient with temporary epicardial pacing must have an intrinsic rhythm with a heart rate of more than 35 bpm and be hemodynamically stable to remain on the cardiac surgery ward. If these parameters are not met, the patient must be transferred to a critical care area.
3. It is the provider's responsibility to check for underlying rhythm, stimulation threshold, and sensing threshold.
4. The provider is responsible for ordering: mode of pacing, rate, output (mA), sensitivity (mV), and activity level.
5. 2 RNs to check pacemaker settings at the beginning of each shift or when there is a change in settings. To be documented in the Device Safety Checklist (see documentation section below)

Algorithm



Need to Know

1. Typically, atrial pacing wires are positioned through the skin to the right of the sternal incision and ventricular wires are positioned to the left side.
2. Epicardial pacing wires (EPW) are always unipolar, meaning that a second positive or ground electrode is necessary to complete the pacing circuit. Therefore, EPW are connected in pairs to the cables in order to pace.
3. The exposed metal end of the wires is a direct route for electrical current from the environment to conduct directly to the heart so care must be taken to insulate the wires to prevent cardiac arrhythmias.
4. If not attached to the pulse generator, epicardial wires must be insulated to prevent micro-shock. See section on Pacing Wire Insulation below.
5. Gloves should always be worn when handling EPW to prevent micro-shock.
6. Anytime epicardial pacing is initiated, new batteries must be used in the pulse generator.

The following cardiac rhythms require temporary pacing **IF** hemodynamically unstable:

- Asystole, more than 3 seconds
- Sinus Arrest/Sinus Block
- Sinus bradycardia
- Junctional bradycardia
- Second degree AV block, Type II
- Third degree AV Block

Protocol

Assessment and Interventions

A. Symptomatic/Emergency Initiation of Pacing:

Bedside cardiac monitoring should be initiated for emergent situations until the patient is stabilized.

For all alarms, check patient's response to arrhythmia (ABC, LOC, SOB, vital signs). **If asystole, call Code Blue immediately, and initiate temporary pacing. Start CPR if unable to pace. Do not delay CPR for more than 1 minute.**

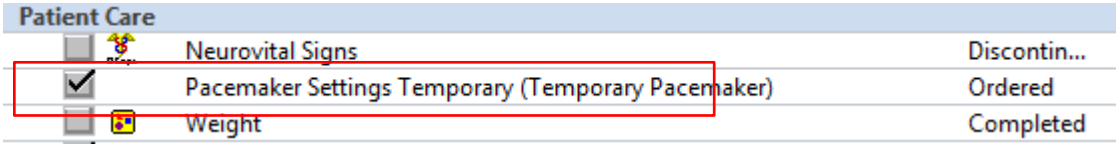
Procedure	Rationale
1. Put on gloves	Gloves prevent transmission of micro-shocks to patient from exposed wires.
2. Identify each wire set as atrial or ventricular. Ventricular wires typically exit from the left side of the sternal incision and atrial wires typically exit from the right side of the sternal incision.	One or both wire sets may be present.
3. Insert the atrial epicardial wires into the blue cable lead, and tighten the cable knobs clockwise until finger tight.	
4. Insert the ventricular epicardial wires into the white cable lead, and tighten cable knobs clockwise until finger tight.	
5. Attach pacing cables to pulse generator: inserting cables into appropriate A or V ports on the generator.	Ensures that the atrial wires do not get inadvertently put in the ventricular input, and vice versa.
6. Insert 2 AA batteries and turn the pacemaker on. It will automatically go to default settings Default settings are: Mode - DDD Heart rate – 80 bpm Output, atrial – 10 mA Output, ventricle – 10 mA Atrial Sensitivity – 0.5 mV Ventricular Sensitivity – 2.0 mV AV interval – 170 ms Atrial Tracking – ON	
7. Assess vital signs, LOC and palpate peripheral pulses to ensure peripheral perfusion	To ensure heart is contracting and perfusing (not just electrical activity)

8. **If patient stabilizes**: Complete full head to toe assessment Notify Provider; confirm orders for mode of pacing, heart rate, output, sensitivity and activity level. Complete documentation of settings. - **If patient has no pulse**: Call a Code Blue if not already called Continue/start CPR if indicated - **If patient remains symptomatic**: Call a Code Blue if not already initiated Give atropine* as per protocol Bradycardia (Cardiac Wards)	
9. Secure the wires and all connections. Place gauze under the cable receptacle and secure to the patient's abdomen with tape.	Provides comfort for the patient and prevention of disconnection from the pacemaker.
10. Lock pulse generator by pressing the lock/unlock key to lock the upper dials; replace plastic cover	Prevents accidental changing of pacemaker settings
11. Place the pulse generator in a secure location, ideally attach to the patient's gown	Avoids accidental disconnection of the pacemaker generator from the pacemaker wires or leads.
12. Obtain and analyze ECG rhythm strip for appropriate capture and sensing. Document rhythm as per Documentation section (see below)	
13. Assess and document vital signs Q15 min until rhythm stable, then Q4H and PRN	To ensure the paced rhythm is appropriate and providing sufficient cardiac output
14. On the central monitor, ensure "paced" mode is selected and Class I has been selected in cardiac settings	
15. Provider (and/or Cardiac Arrest team) will decide appropriate location for patient based on the policy criteria.	

* Indicates provider order required

B. Transfer from CSICU with temporary pacing already initiated:

1. Ensure order for Temporary Epicardial Pacing entered into Cerner prior to transfer



2. Review pacemaker settings and ensure pacemaker connections and pulse generator are secured to patient with CSICU RN. Document pacemaker settings and complete Device Safety Checklist in Cerner- see documentation section below
3. Mount and analyze ECG rhythm strip for appropriate pacing, capture and/or sensing (if not appropriate see Appendix A)

C. All Temporary Paced Patients:

1. Conduct a complete head to toe assessment as per protocol.
2. Assess and document vital signs Q4H and PRN.
3. 2 RN's to assess and document pacemaker settings at the beginning of each shift and with any change to settings (see Appendix C on how to document double check in Cerner).
4. Complete Device Safety Checklist Q4H and PRN.
5. Assess patient's understanding of pacing (purpose, activity, restrictions etc.); provide simple explanations and reassure patient and family.
6. When pacing is discontinued, disconnect pulse generator from pacing wires and leave at bedside for 24 hours in case of urgent need to reconnect. Insulate pacing wires as described below. After 24 hours, the pulse generator may be removed from the bedside.
7. Pulse generators should be cleaned and stored in the clean utility room when pacing is discontinued. Remove batteries from the pulse generator before storing away. Used/dirty pacing cables are placed in the dirty utility room in the blue bin labelled "return to MDRD".

D. Pacing Wire Insulation:

- Assess skin at EPW exit site every shift and PRN for redness, warmth, pain, drainage.
- Ensure EPW are securely insulated, secured to the skin, and have not been accidentally dislodged.
- If there are no signs and symptoms of infection, change dressing PRN. If signs and symptoms of infection are present, notify provider and change dressing daily as outlined below:

Equipment & Supplies:

- Gloves
- Dressing tray
- Normal Saline
- 1 or 2 “fingers” cut from a glove
- Small transparent dressing

Procedure	Rationale
1. Put on gloves	Prevents transmission of micro-shocks to patient by nurse during handling of exposed wires.
2. Using aseptic technique, cleanse pacemaker wire exit sites with normal saline, allow to dry. Cover exit sites with transparent dressing.	Sterile transparent dressing prevents infection, allow for regular assessment of insertion site and easy access of pacing wires in emergency situations.
3. Cover metal ends of epicardial wires with glove “fingers” and secure to skin with sterile transparent dressing.	Glove fingers prevent transmission of micro-shocks to patient from exposed wires.

E. Post Removal Care of Epicardial Pacing Wires:

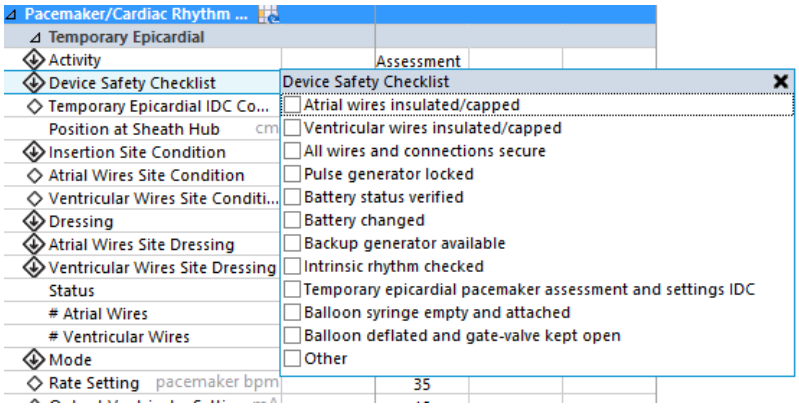
- Epicardial pacing wires are removed on or after day 3 postoperatively for cardiac surgery patients and on or after day 4 post-operatively for heart transplant patients (if patient in sinus rhythm or stable cardiac rhythm as determined by provider)
- The Provider will be responsible for the wire removal. CNE/CNL’s who have been certified in removal, may also remove pacing wires, with an order from a provider
- **IV Heparin is to be stopped 4 hours prior to pacing wire removal.** Please obtain an order for Heparin to be held and for when it should be restarted post removal
- Patients are monitored post wire removal for complications like arrhythmias, bleeding at exit site, and cardiac tamponade (caused by atrial or ventricular laceration during wire removal). Many patients with pacing wires have been anticoagulated for other cardiac reasons and are at a higher risk for cardiac tamponade.
- Observe for the following signs and symptoms while patient is on **bed rest for 45 minutes:** muffled or quiet heart sounds, tachycardia, hypotension or labile BP, tachypnea, chest pain, dyspnea, anxiety, altered level of consciousness, bleeding, arrhythmias.
- Patient may be discharged **a minimum of 4 hours after EPW removal.**

Procedure	Rationale
1. Assess baseline vital signs and rhythm prior to wire removal	To have a hemodynamic base line from which to assess any changes post wire removal
2. Post removal, check patient response and assess vital signs: Q 15min x 3	In order to see early changes in hemodynamic status
3. Instruct patient to remain on bed rest for 45 minutes post removal and to report feelings of shortness of breath, dizziness, anxiety, restlessness, chest discomfort, nausea, or rapid heartbeat.	To monitor for potential complications like tamponade, bleeding, dysrhythmias
4. Contact the provider if any adverse reactions occur. **If the patient becomes hemodynamically unstable call a Code Blue immediately.**	

Documentation

In Cerner PowerChart:

- Vital Signs
  - Interactive View and I & O >> Adult Quick View >> vitals signs
- ECG Rhythm
  - Interactive View and I& O >> Adult Systems Assessment >> Cardiac Rhythm Analysis
- Pacemaker settings and Device Safety Checklist (completed at start of shift and with any changes in settings)
  - Interactive View and I& O >> Adult Systems Assessment >> Pacemaker/Cardiac Rhythm Devices



NOTE: The following items on the Device Safety Checklist DO NOT apply to the inpatient ward:

- Intrinsic Rhythm checked, Balloon syringe empty and attached and Balloon deflated and gate valve kept open

In Chartlet

- ECG Rhythm Strip Flow sheet – print and mount rhythm strip with analysis every shift and with any significant change in rhythm or vital signs.

Patient and Family Education

1. Briefly describe need for pacemaker. Explain pacemaker function in simple terms, and temporary nature
2. Ask patients to report feelings of chest discomfort, nausea, dizziness, diaphoresis, shortness of breath
3. Describe restrictions such as activity level, not to handle the pacemaker or EPWs, and not to leave the unit

References

1. Aehlert, B. (2006). Pacemaker rhythms. In A. Allen (Ed.), *ECG's Made Easy, Third Edition* (pp. 211-224). Philadelphia: Mosby, Inc.
2. Hodgson, B., Smith, M. (2012). Learning module for removal of temporary epicardial pacing wires. *Capital Health*.
3. Homoud, M., Sinus Bradycardia. In *UpToDate,* Post T.W. (Ed), UpToDate, Watham, MA. (Accessed on June 27, 2022.
4. Medtronic, Inc. (2016) 5392 Dual Chamber Temporary External Pacemaker; Technical Manual. Minneapolis, MN; Medtronic, Inc.
5. Reade, M. (2007). Temporary epicardial pacing after cardiac surgery: Part 1: General considerations in the management of epicardial pacing. Anaesthisia, 64. pp. 264-271.
6. Woods, S., Sivarajan Froelicher, E., Underhill Motzer, S., Bridges, E. (2005) *Cardiac Nursing* (5th ed.) pp. 709-755. Philadelphia: Lippincott.

Appendices

Appendix A – Trouble Shooting Pacemaker Complications

Appendix B – Medtronic 5392 Battery Replacement

Appendix C – Documenting the Double Check in Cerner

Appendix A: Trouble Shooting Pacemaker Complications

Problem	Possible Cause	Possible Nursing Interventions
Failure to capture: when pacemaker fires but fails to depolarize. Pacemaker spikes are not followed by P wave/QRS complex	• Loose connection (poor contact between pacing wires, cable and /or pulse generator) • Inadequate output strength • Fractured lead wire • Dislodgement of epicardial pacing lead from heart • Battery failure • Pulse generator malfunction	• Check patient • Check all connections • Call code if patient is acutely decompensating • Notify provider: You may be asked to increase output. Turn **UP** output to 15-20 mA. Check for palpable pulse with each captured spike. • Consider changing battery • Consider changing pulse generator • Reposition patient on left side
Failure to pace/fire: when the pacemaker fails to deliver an electrical stimulus. Absence of pacemaker spikes.	• Oversensing • Loose connections • Sensitivity too high • Fractured lead wire • Dislodgement of epicardial pacing lead from heart • Pacemaker set up incorrectly • Battery failure • Pulse generator malfunction	• Check patient • Call code if patient is acutely decompensating • Notify provider: You may be asked to decrease sensitivity (mV). To decrease sensitivity, turn **dial counterclockwise** (numbers will increase). • Check all connections • Consider changing battery • Consider changing pulse generator • Reposition patient
Undersensing: when the pacemaker fails to recognize intrinsic myocardial activity and therefore generates unnecessary pacing spikes. Can be thought of as “overpacing”.	• Loose connection • Inadequate QRS signal • Fractured lead wires • Dislodgement of epicardial pacing lead from heart • Battery failure	• Check patient • Call code if patient is acutely decompensating • Notify provider: You may be asked to increase sensitivity (mV). To increase sensitivity turn the dial **clockwise** (numbers will decrease)

Pacing spikes firing indiscriminately throughout cardiac cycle		• Increase ECG gain amplitude as directed by a physician • Reposition patient
Oversensing: when the pacemaker senses internal and external signals as QRS complexes and inhibits pacemaker output Absence of pacing spikes when they are expected	• Loose connection • Sensitivity too high • Fractured lead wires • Dislodgement of epicardial pacing lead from heart • Battery failure • Electromechanical interference from items like razors, radios	• Check patient • Call code if patient is acutely decompensating • Notify provider: You may be asked to decrease sensitivity (mV). To decrease sensitivity turn **dial counterclockwise** (number will increase) • Reposition patient • Remove electrical devices that may interfere
Diaphragmatic pacing/ Phrenic Nerve Stimulation: when the lead stimulates the phrenic nerve Hiccupping ECG artifact	▪ Stimulation of the phrenic nerve.	• Check patient • Notify provider: You may be asked to decrease output (mA). To decrease output, turn **DOWN** mA • Reposition patient on their side

Appendix B – Medtronic 5392 Battery Replacement

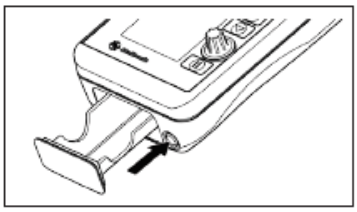
MEDTRONIC MODEL 5392

BATTERY REPLACEMENT

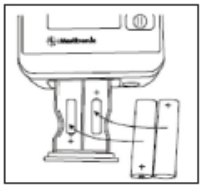
Battery Installation and Replacement

Note: Medtronic recommends disconnecting device from patient before replacing battery.

1. Press the battery drawer latch release button until the battery drawer opens.



2. Remove the old batteries.
3. Install two new LR6-sized (AA-sized) alkaline batteries. Verify that the batteries align with the polarity markings on the inside of the battery drawer.



4. Close the battery drawer firmly until the battery drawer is fully latched.

Note: Failure to close the battery drawer completely can result in the battery drawer opening and the temporary pacemaker shutting down.

5. Discard the old batteries properly according to local regulations.

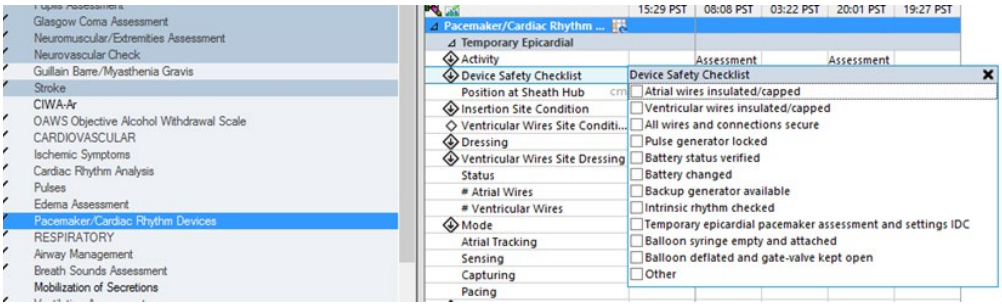
Notes

- Replace the temporary pacemaker batteries in the following situations:
  - Replace the batteries for each new patient
  - Replace the batteries when the low battery indicator appears during temporary pacemaker operation
  - Replace the batteries at least once every week when the temporary pacemaker is in continuous use
- Install the batteries with proper polarity. The temporary pacemaker does not turn on or provide pacing therapy with incorrect battery polarity
- If during an emergency situation the batteries must be replaced while the temporary pacemaker is in use, ensure that the temporary pacemaker is locked before replacing the batteries. Pacing is maintained at the current settings for 30 s, minimum, if the settings are at nominal values.

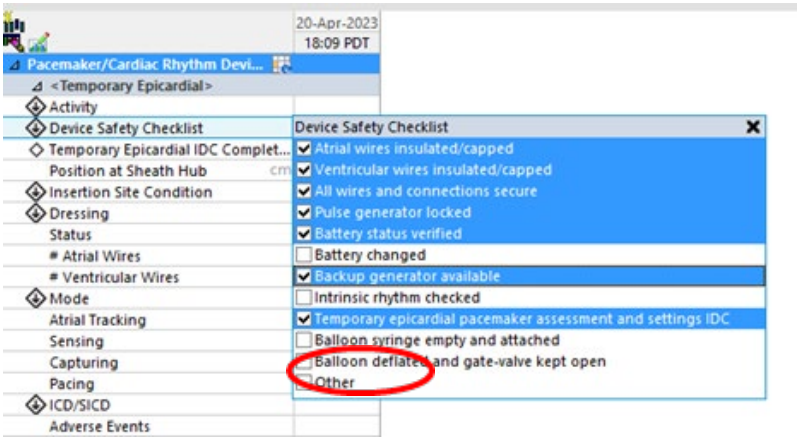
Appendix C: Documenting the Double Check in Cerner

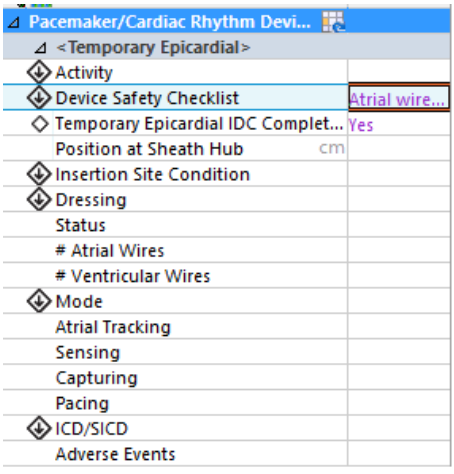
Reminder- perform a double check regarding settings and pacing equipment with another nurse on admission, at the beginning of each shift or when settings have been changed.

1. To document this Double check- **click on the 'Device Safety Checklist'**

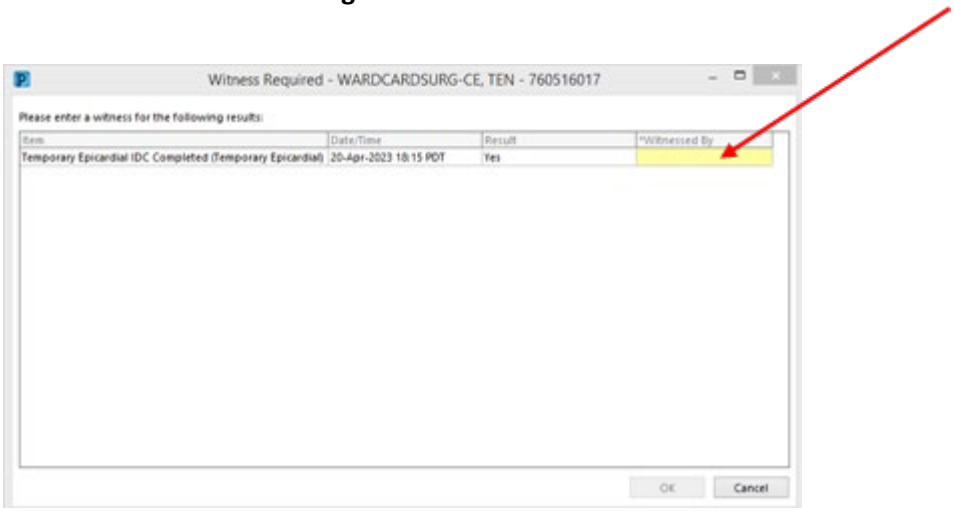


2. Ensure that you click on **'Temporary epicardial pacemaker assessment and settings IDC'** as this will open the next cell **'Temporary Epicardial IDC completed'** → enter "Yes"

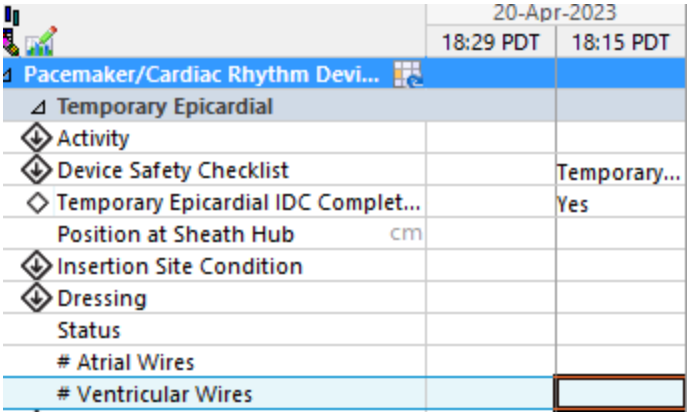




3. After you have completed the rest of your charting and go to sign- a box will pop-up for you to enter the name of the second RN doing the check with you. **Enter the name and press OK and then Witness the Sign.**



4. If the double check is done correctly, this is what it should look like below.



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