

**MUNROE REGIONAL MEDICAL CENTER
OUTPATIENT HEART FAILURE TREATMENT CENTER**

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IMPEDANCE CARDIOGRAPHY UTILIZATION PROTOCOL

Introduction

The Heart Failure Treatment Center is an outpatient department of Munroe Regional Medical Center in Ocala, Florida established to effectively manage and treat patients with heart failure. In providing quality care, we incorporate the technology of bio-impedance to aid in designing a treatment plan for patients with heart failure. Non-invasive hemodynamic measurements are obtained using the technology of bio-impedance. The concept of dynamic resistance or impedance is the measurement caused by changes in blood volume and velocity in the aorta during ventricular contraction. This value, along with simultaneous blood pressure and electrocardiogram (ECG), is then used in determining the derived parameters of stroke volume, cardiac output, cardiac index, systemic vascular resistance and systolic time ratio (pre-ejection period divided by systolic ejection time). It is the use of a comprehensive and state of the art technology like the Impedance Cardiography (ICG) that we aim to provide objective and definitive measures for treatment. The utilization of ICG in an out patient setting by the skillful practitioner provides an efficient method of treatment determination. Furthermore, an ICG is cost effective in evaluating non-invasive, hemodynamic values crucial in the management of heart failure patients. In the past, effective methods for acquiring information about the hemodynamics of the heart were through a pulmonary artery (swan ganz) catheterization or right heart catheterization, which are invasive procedures, risky and only performed in the hospital setting.

Description

Impedance Cardiography is an innovative, noninvasive device that provides hemodynamic parameters based on the measurement of thoracic electrical impedance. It works by applying four dual sensors to the neck and chest to measure the resistance to a small electrical current. Measurement and calculation of hemodynamic parameters are determined through changes in resistance. The ICG provides the practitioner with vital information about the heart's ability to deliver blood to the body, the force the heart exerts with each beat, and the amount of fluid in the chest. The technology quantifies the mechanical activity of the heart (blood flow) rather than its electrical activity (ECG).

Mechanics of Impedance Cardiography

- Alternating current is transmitted through the chest
- Current seeks path of least resistance: blood filled aorta
- ICG measures the baseline impedance to the current
- With each heart beat, blood volume and velocity in aorta changes
- ICG measures the corresponding change in impedance
- ICG utilizes the baseline and changes in impedance to measure and calculates hemodynamic parameters

ICG Parameters

The following parameters are obtained from the BioZ[®] (CardioDynamics, San Diego, California) for treatment purposes.

- Cardiac Output/ Cardiac Index (CO / CI)
- Systemic Vascular Resistance/ Systemic Vascular Resistance Index (SVR / SVRI)
- Stroke Volume/ Stroke Index (SV / SI)
- Thoracic Fluid Content (TFC)
- Systolic Time Ratio (Pre-ejection Period/Left Ventricular Ejection Time)

Purpose of ICG Parameters

- Provides baseline non-invasive hemodynamic measurements for all new patients to facilitate tracking and trending patterns
- Objectively quantifies patient outcomes following outpatient pharmacologic therapy
- Trends non-invasive parameters to assist in the decision for initiating, deleting or titrating drug therapy
- Objectively assists in the education of heart failure patients to foster medication compliance

Charge code

Utilize the following CPT code for reimbursement purposes: 93701

Staff Who Can Perform Test

Registered Nurses, LPNs or Technicians, Nurse Practitioners, Physician or any staff trained to perform procedure by CardioDynamics, Inc.

Staff Competency

(See Appendix 1)

Training Needed

- In-service
- Installation and troubleshooting of BIO Z (ICG) machine
- Certification of staff before using ICG
- Clinical support and additional training

Appropriate Healthcare Provider Who Can Interpret BIO Z/ICG at the MRMC/HFTC
Physician, Nurse Practitioner (Physicians Assistance if available)

Clinical Application

New patient/First visit

- a. Baseline measurement
- b. Correlate history and physical examination, presenting signs and symptoms with hemodynamic measurements
- c. Determine cause of symptoms that may affect hemodynamics
- d. Initiate or change therapy affecting hemodynamics
- e. Use ICG in determining treatment goal or formulating plan of care
- f. Use ICG in patient education, using the hemodynamic readings to help patient understand pharmacological therapy and the need for compliance

Follow up visits

- a. Trend hemodynamic readings
- b. Determine cause of change in symptoms affecting hemodynamic measurement
- c. Initiate and/or titrate pharmacologic therapy
- d. Correlate presenting signs and symptoms, physical examination with hemodynamic measurements
- e. Use ICG in patient education, using the hemodynamic readings to help patient understand pharmacological therapy and the need for compliance

Indications for Congestive Heart Failure

Clinical Manifestations of Heart Failure

Evaluation of progressive or persistent edema

Evaluation of progressive fatigue

Evaluation of the cause of symptomatic hypotension or hypertension

Distinguish cause of shortness of breath, cardiac vs. pulmonary

Pharmacological Options and Titration

Ace Inhibitor, ARBs, Hydralazine/Nitrates

Beta-blockers

Diuretics

Aldactone Antagonist

Nesiritide

Positive Inotropic agents

Procedure for ICG

1. Perform test in a designated room during patient visit
2. Explain test to patient
3. Attach sensors appropriately to the patient's neck and chest
4. Enter patient data (name, gender, age, height, weight)
5. Take patient's blood pressure and enter data or use ICG BP)
6. Confirm acceptable ICG (Delta Z) and ECG waveforms
7. Print status report with acceptable ICG tracing
8. Detach sensors
9. Refer to Treatment Algorithm for CHF or HTN
10. Evaluate results and compare to previous results if available
11. Provide appropriate treatment plan and pharmacological options
12. Explain ICG results to patient and family
 - Use ICG results to help patient understand treatment goal
 - Example: Initiate or titrate ACE-I for a low CI, elevated SVRI, etc.
 - Use ICG results to improve patient compliance
 - Example: Showing trend improvement or deterioration, etc.
 - Obtain baseline ICG and during follow up visits for comparison

Maintenance of ICG Machine

1. Maintain ICG plugged in at all times
2. Keep machine clean at all times and dust free
3. Change ICG sensors before each patient and always ready for the next patient
4. Also keep printer plugged in and paper ready for printing
5. Check printer ink and supplies to make sure its readiness
6. When moving the ICG to another, plug as soon as possible

APPENDIX I

**Munroe Regional Medical Center
Heart Failure Treatment Center
Impedance Cardiography Competency Checklist**

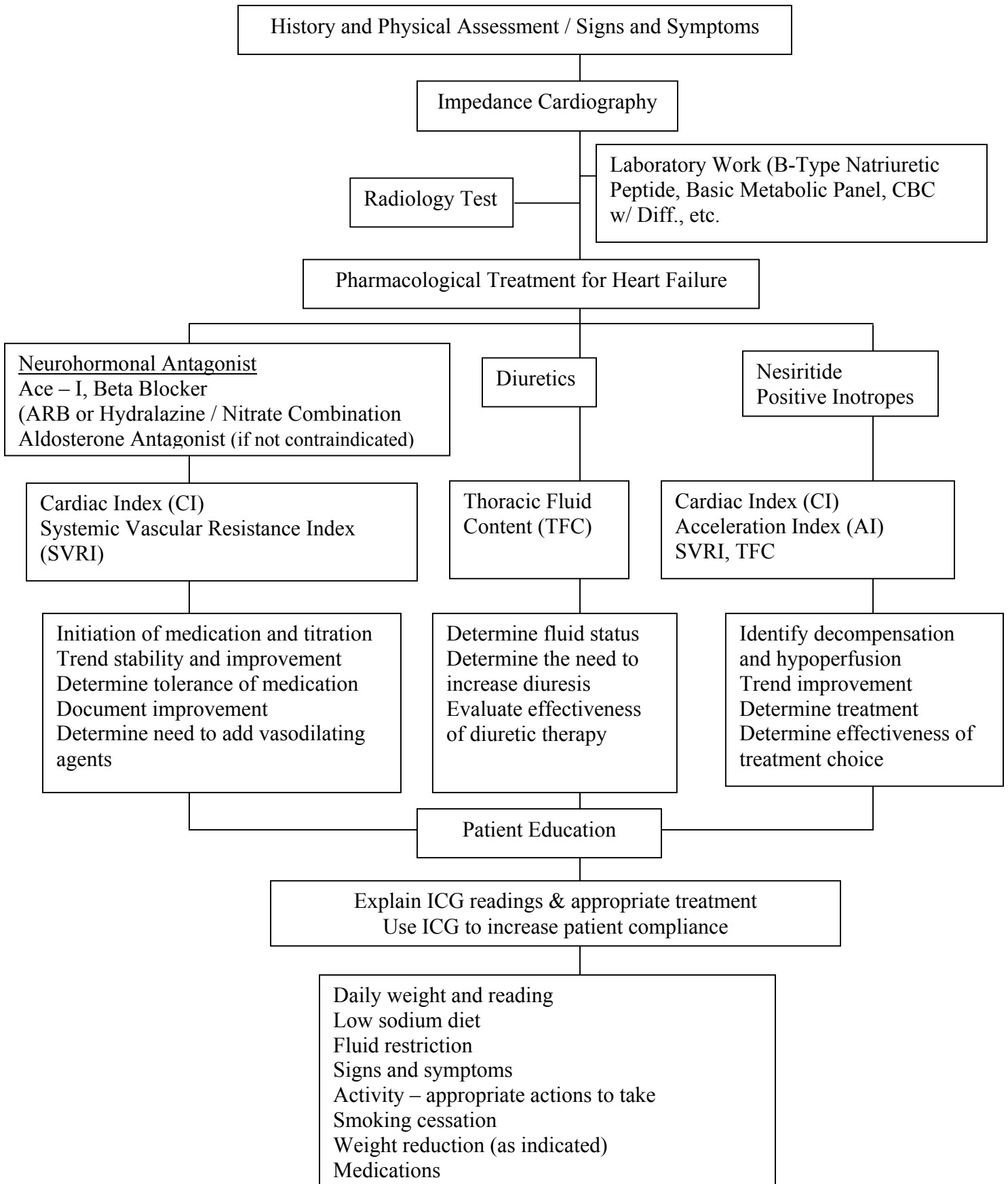
Task	Yes	No	Comment
1. Able to set up Impedance Cardiography machine adequately.			
2. Accurate data entry of patient information.			
3. Explain procedure to patient.			
4. Explain rationale for the use of Impedance Cardiography (ICG).			
5. Properly positioning of patient for ICG test.			
6. Proper attachments of ICG patches or leads.			
7. Proper handling of ICG machine.			
8. Ensure and observe patient safety during test.			
9. Proper print out of report.			
10. Change printer ink and fill paper correctly.			
11. Able to trouble shoot ICG equipment.			
12. Notify MD or ARNP of abnormal findings.			

SIGNATURES:

Employee:	Date:
Evaluator:	Date:

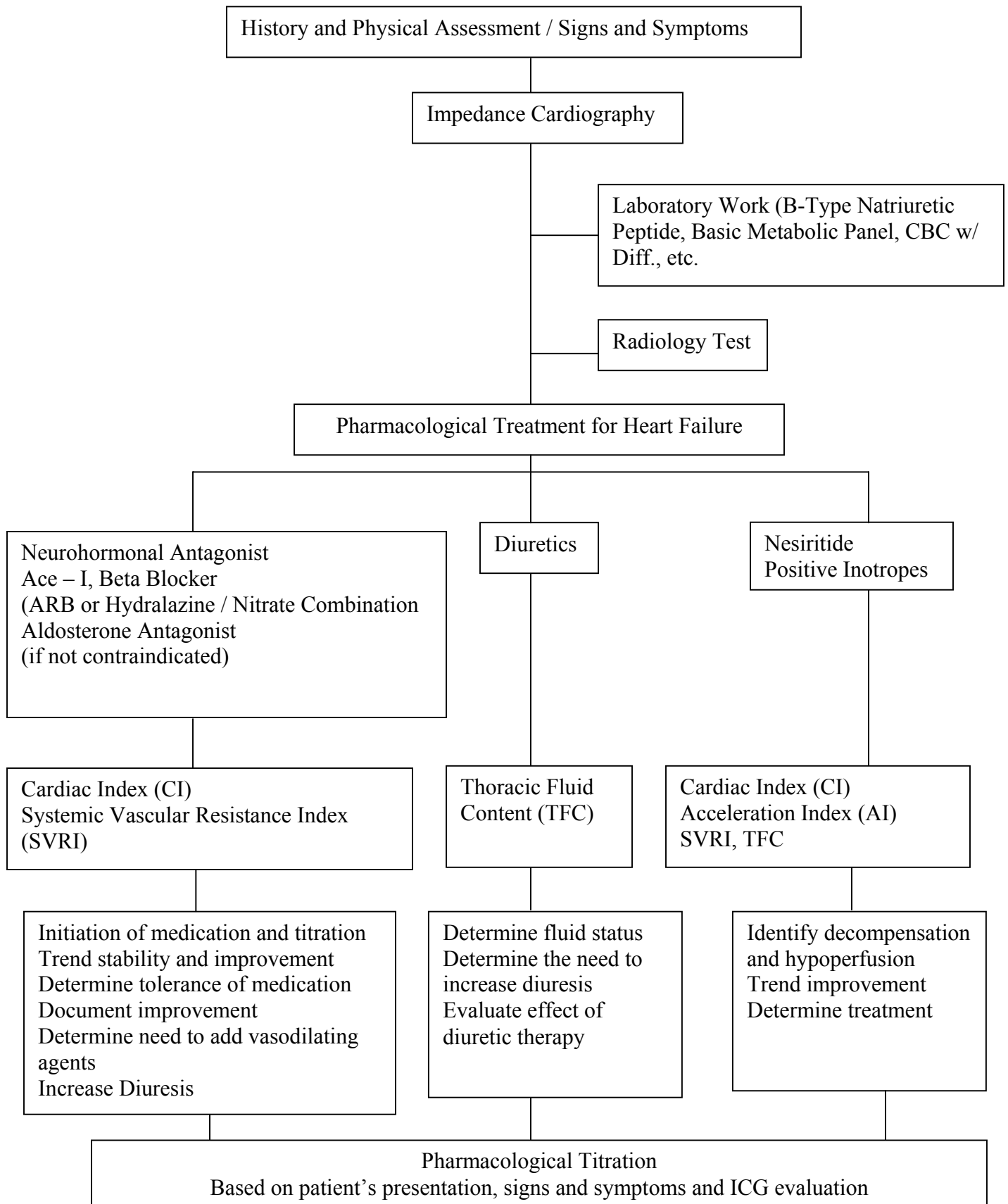
APPENDIX II

IMPEDANCE CARDIOGRAPHY (ICG) USE IN TREATMENT STRATEGY



APPENDIX III

ICG UTILIZATION FOR PHARMACOLOGIC OPTION MANAGEMENT



For Pharmacologic Options refer to: Yancy C, Abraham WT. Noninvasive hemodynamic monitoring in heart failure: utilization of impedance cardiography. *Congest Heart Fail.* 2004;10(3):139.

APPENDIX IV

ICG OUTPATIENT UTILIZATION ALGORITHM

