Cardiovascular:
Ventricular Assist Device (VAD)

Goals: To assist UTSW/Parkland BioTel EMS Providers when evaluating and treating a patient with a Ventricular Assist Device (VAD)
Inclusion Criteria: All patients with a Ventricular Assist Device (VAD)
Exclusion Criteria: Patients without a Ventricular Assist Device (VAD)
Refer to: UNIVERSAL CARE – ADULT and to Cardiac Arrest and other relevant, symptom-specific CPGs

Definition

1. A Ventricular Assist Device (VAD) is an implantable device used to artificially augment cardiac output and to support circulation in patients with significant ventricular dysfunction:
    a. VAD mechanics differ, depending on the manufacturer

Special Considerations of VAD Patients

1. **Chest compressions should not be started in an unresponsive patient until the pump is checked**:
    a. CPR or blunt chest/abdominal trauma may dislodge VAD tubing, resulting in fatal bleeding
        i. This risk is greatest in the first 10 days after initial implant surgery
    b. **Indications for chest compressions are outlined in Patient Care, section 2.e.ii (next page)**
2. A VAD patient **may not have a palpable pulse**, as most VADs support circulation with laminar (continuous) flow:
    a. Even if present, the palpable pulse may not match the true heart rate
3. A VAD patient **will have a heart rate and rhythm on ECG**:
    a. ECG monitoring is the only way to determine the VAD patient's heart rate and rhythm
    b. Dysrhythmias should be treated according to standard BioTel CPGs and ACLS Guidelines, EXCEPT for chest compressions
    c. Defibrillation or cardioversion may be performed according to standard guidelines
4. A VAD patient **may not have a SBP or DBP** obtainable by standard methods with a manual or automated BP cuff:
    a. Measurement of mean blood pressure (typical range 65-100 mmHg) may require a Doppler device, if auscultation is unsuccessful
5. **Pulse oximetry** may not be measurable or accurate
6. **Continuous waveform capnography** should be used for all VAD patients
7. There are **no medication contraindications** related to the VAD
8. **Overall clinical assessment is the most important clinical observation** (e.g. responsiveness, skin color and perfusion, respiratory rate and effort)
9. A VAD patient will most likely be accompanied by a trained companion:
    a. The companion is familiar with the VAD and with emergency troubleshooting
    b. **The companion should accompany the patient during transport and be responsible for the VAD whenever possible**
10. VAD patients and their companions are taught, in an emergency, to call 911 and then to page the on-call VAD Coordinator immediately:
    a. The **VAD Coordinator** will typically be on the phone to provide assistance to EMS Providers when they arrive
    b. The patient/companion will know how to contact the on-call VAD Coordinator, if necessary
    c. In addition, **contact information for the VAD Coordinator and VAD Implant Center is usually attached to or located inside the patient's VAD equipment bag**
11. **The VAD equipment bag, power source, battery and charger should be transported with the patient**
12. A VAD patient should typically be transported to the nearest appropriate VAD center, with preference given to **their implanting VAD center whenever possible**

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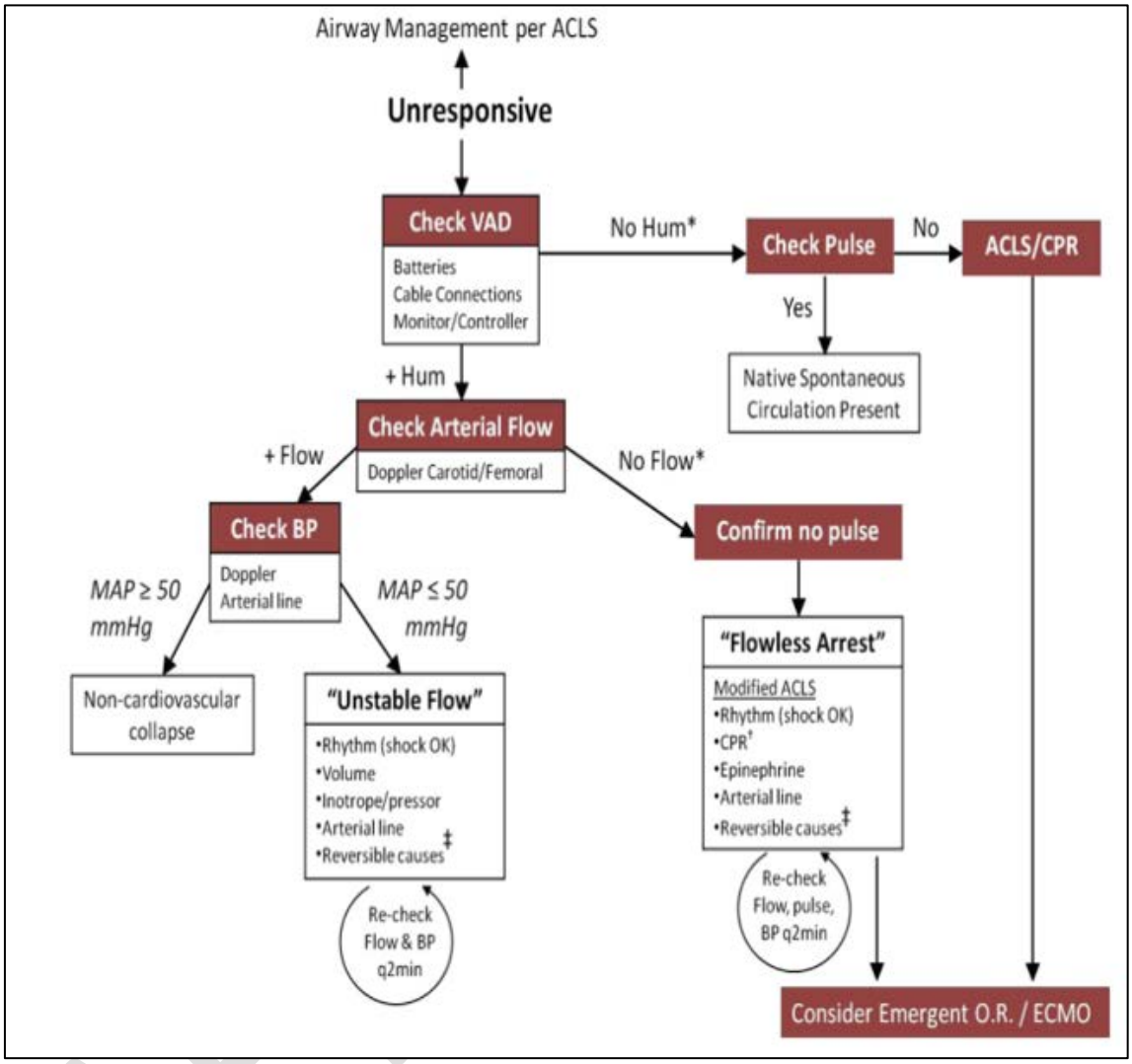
Patient Care

1. RESPONSIVE patient:
    a. Check VAD for alarms
        i. If alarms are activated, contact the VAD Coordinator or BioTel
    b. Check the VAD battery indication
        i. Change batteries or connect to AC power, if indicated
    c. Management per symptom-specific CPG
        i. Synchronized cardioversion or defibrillation may be performed, if necessary
        ii. If evidence of dehydration, establish IV/IO access and administer 250 mL NS bolus
            a. Reassess and repeat once to restore MAP to at least 65 mmHg
            b. Do not administer additional fluid without BioTel or VAD Coordinator authorization
    d. Obtain the patient's Emergency Contact Card, travel batteries, charger and battery pack
    e. Contact BioTel for destination decision-making assistance
        i. If possible, transport to the patient's implanting VAD center
2. UNRESPONSIVE patient:
    a. Do NOT begin chest compressions before checking the pump (see Section e, below)
    b. Evaluate airway and support with positioning, adjuncts and assisted ventilation with BVM and supplemental oxygen (refer to Airway Management – Adult CPG):
        i. Place advanced airway (supraglottic airway or ET tube) as needed (advanced level only)
            a. Initiate continuous waveform capnography ($PetCO_2$ monitoring)
    c. Assess VAD pump for function:
        i. Check peripheral pulses
        ii. Auscultate for humming sound at left upper abdominal quadrant
        iii. Check for capillary refill
    d. If pump **IS** functioning:
        i. Initiate continuous ECG monitoring using hands-free defibrillator pads, not limb leads
        ii. Manage patient according to symptom-specific CPG
        iii. If evidence of dehydration, establish IV/IO access and administer 250 mL NS bolus
            a. Reassess and *repeat once* with an additional 250-mL bolus if MAP is less than 50 mmHg or if the alarm is for "suction event"
            b. Do not administer additional fluid without BioTel or VAD Coordinator authorization
    e. If there is **NO INDICATION** of pump function:
        i. Evaluate the VAD for power loss/equipment issues:
            a. Change batteries, if necessary
            b. Connect to AC power
        ii. Chest compressions may be performed in an unresponsive patient, IF the pump is not functioning and cannot be restarted in a timely manner
    f. Obtain the patient's Emergency Contact Card, travel batteries, charger and battery pack
    g. Contact BioTel for destination decision-making assistance
        i. If possible, transport to the patient's implanting VAD center
3. For additional patient care considerations not covered under this CPG, refer to symptom-specific CPGs or contact BioTel

Refer to the flow diagram on the following page for additional guidance


Airway Management per ACLS
Unresponsive
Check VAD
Batteries
Cable Connections
Monitor/Controller
No Hum*
Check Pulse
No
ACLS/CPR
Yes
Native Spontaneous Circulation Present
+ Hum
Check Arterial Flow
Doppler Carotid/Femoral
+ Flow
No Flow*
Check BP
Doppler
Arterial line
Confirm no pulse
MAP ≥ 50 mmHg
MAP ≤ 50 mmHg
"Flowless Arrest"
Modified ACLS
•Rhythm (shock OK)
•CPR†
•Epinephrine
•Arterial line
•Reversible causes‡
Non-cardiovascular collapse
"Unstable Flow"
•Rhythm (shock OK)
•Volume
•Inotrope/pressor
•Arterial line
•Reversible causes‡
Re-check Flow & BP q2min
Re-check Flow, pulse, BP q2min
Consider Emergent O.R. / ECMO