Supplement 2. Complications Associated with Ambulation

<table>
<thead>
<tr>
<th>Complication</th>
<th>Total (N=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total complications (%)</td>
<td>4 (40%)</td>
</tr>
<tr>
<td>Major complications:</td>
<td></td>
</tr>
<tr>
<td>Limb ischemia</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Aneurysm/dissection</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>IABP rupture/kinking</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>IABP exchange</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Stroke</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Hemodynamic compromise</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Major bleeding requiring intervention/transfusion</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Death related to IABP/ambulation</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Minor complications:</td>
<td></td>
</tr>
<tr>
<td>IABP migration/repositioning</td>
<td>3 (30%)</td>
</tr>
<tr>
<td>Minor bleed/hematoma</td>
<td>1 (10%)</td>
</tr>
<tr>
<td>Insertion site infection</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Paresthesia/Pain ipsilateral limb</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Changes in augmentation</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Console malfunction</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Supplement 3. Ambulation Protocol

Title: Guideline for Ambulating Patients with Femoral Intra-Aortic Balloon Pumps

Purpose: Provide Standardized Procedure Guidelines for the ambulation of the adult patient with a femoral Intra-Aortic Balloon Pump (IABP). Minimize or prevent deconditioning of the heart failure patient with IABP

Scope: Physicians, Advanced Practice Providers. Registered Nurses, Physical Therapists, Respiratory Therapists

Procedure:

1. History:
   - Determine Patient’s prior level of function, ambulation status and need for assistive devices
   - Determine Patient’s weight bear status; patient needs to be weight bearing as tolerated bilateral lower extremities.
   - Evaluate for history of syncopal episodes just prior to or within this hospitalization
   - Patient should not be intubated or on rescue CPAP/BiPAP
   - Patient is hemodynamically stable for at least 24 h
   - Place patient on tilt bed. Patient should tolerate verticalization on tilt bed to standing prior to ambulation.
2. **Contraindications to Ambulation- Including but not limited to:**

- Hemodynamic Compromise: Symptomatic hypotension or unstable heart rate/rhythm during ambulation or tilting process that does not improve with time
- Patient Intolerance
- Intubated patient or on rescue BiPAP, CPAP
- HR>150 BPM
- Pulse Ox <90%

3. **Relative Contraindications to Ambulation- Requires discussion with Intensivist and/or Heart Failure Team**

- Abnormal baseline cognition, sensation, strength, pulses observed during examination
- Changes to IABP function/IABP insertion site
- Changes in IABP position/dislodged
- Bleeding/hematoma at insertion
- New arrhythmias
- HR 130-150 BPM
- Subjective new complaints of lower extremity/upper extremity numbness

4. **Examination**

a. Cognition- patient is alert and oriented, able to follow 2-step commands
b. Manual Muscle Testing at least 4 out of 5 strength for hip abduction, knee extension/ flexion, ankle dorsiflexion and plantar flexion on the leg with the balloon pump insertion site, for hip flexion, hip abduction, knee extension/ flexion, ankle dorsiflexion and plantar flexion on the other leg
c. Sensation unchanged from prior assessment
d. Pulses assessed and present
e. IABP site check
   A. Examine Insertion Site for hematoma, bleeding
   B. Examine integrity of sutures and/ or other securing devices

5. **Consult Physical Therapy for assessment and treatment;** specify goal/ intent of ambulation with IABP. Specify restrictions and vital sign parameters including maximum hip flexion allowed on the femoral access side

PT to assess functional status and physical appropriateness for ambulation to include range of motion, strength, balance and gait.

6. Place Order to ambulate patient with IABP that includes vital sign parameters. Order needs to state that the patient meets requirements for assisted ambulation and needs to include any ROM restrictions e.g. for hip flexion at the femoral access site.

7. Ambulation is to occur between hours of 9am and 4pm to ensure maximal in house personnel available in case of emergency including the cath lab.

8. Minimum staff requirement for Ambulation with IABP: Physician (Heart Failure Attending/ fellow or Intensivist/ Attending), RN, Physical Therapist; PCA or additional RN to assist with IV poles/oxygen. In collaboration with the other members of the ambulation team the physician will be responsible to monitor therapy tolerance including augmentation.

9. General Fall Precaution Guidelines are observed.

10. **Ambulation Procedure**

a. Patient must be cleared for ambulation by either the heart failure team or Intensivist attending.

b. Chest X-ray prior to ambulation to confirm positioning of the pump must be reviewed with heart failure provider or intensivist.

c. **Treatment Set-up:**
Obtain resting vital signs
Apply tilt bed straps (2 to 3) to patient - One strap across abdomen (between naval and xiphoid process)
• Note: If pt. has line/tube exiting abdomen, move strap above/below this line
One strap across knee (Either at tibial tuberosity or at superior pole of patella)
If using a third strap, apply across mid-thigh.
Once secured onto tilt table/bed, level transducer for invasive lines as well as IABP console and begin tilting process
  _ Note: Intra-aortic pressure, augmented diastolic pressure, and vital signs should be continuously assessed throughout treatment.
d. Treatment - Tilting
  o In supine (0 degrees)
    _ Assess vital signs (from IABP console)
    o Tilt to 30 degrees
      _ Assess vital signs
      _ Assess for signs of intolerance (dizziness, chest pain, new numbness/tingling in legs or arms)
    o Tilt to 60 degrees
      _ Assess vital signs
      _ Assess for signs of intolerance
    o Tilt to 90 degrees
      _ Assess vital signs
      _ Assess for signs of intolerance

→ A drop in augmentation pressure is expected and should be tolerated as long as the patient does not report any symptoms. However, if augmentation goes down below 55 then check with covering heart failure attending before undertaking ambulation.
→ Heart rate can go up during tilt process. If HR above 150 bpm, team needs to discuss the heart rate with the covering heart failure attending before ambulating.
→ Heart Rhythm changes will be monitored and assessed by provider present who will determine if ambulation can be continued.
e. Treatment - Pre-ambulation
  o In upright standing, check IABP augmentation (>55), HR (<150 bpm), pulse ox >90%; reassess insertion site; check patient for symptoms (significant dyspnea, chest pain, chest pressure, dizziness). If patient is able to tolerate the upright position:
    o Provide Rolling Walker (RW) to patient.
    o Loosen tilt bed straps
    o Begin weight shifting, progressing to marching in place only with leg without the balloon pump while remaining on tilt bed.
      _ Assess vital signs
      _ Assess for signs of intolerance (symptoms, Vital Signs, IABP augmentation)
    o Remove tilt bed straps
    o Step off tilt table with leg housing IABP, and follow with opposite leg
f. Treatment - Ambulation
  o Pending adequate strength/balance, begin walking with Rolling Walker support
    • Assess vital signs continuously.
• Assess for signs of intolerance (dizziness/chest pressure/pain/groin site pain/poor augmentation).
  If having poor ECG tracing due to walk then transition from ECG to pressure mode on IABP at the discretion of the physician
• Guard patient with hands-on assistance throughout
• Increase walking distance as tolerated
• Stop ambulation if symptoms, loss of augmentation, bleeding
  g. **Treatment- Returning onto tilt bed**
  o Tilt bed is in full upright position
  o Patient approaches bed and turns back to bed
  o Step backwards onto bed with leg not housing IABP, followed by opposite leg.
  o Secure straps onto knee and abdomen
    _ Assess vital signs
    _ Assess for signs of intolerance
  o Begin tilting back to supine, stopping at 45 degrees, or as often as patient requests
    _ Assess vital signs at 45 degrees
    _ Assess for signs of intolerance at 45 degrees
  o In supine, remove straps and knee immobilizer.
    _ Assess vital signs
    _ Assess for signs of intolerance
  h. **Conclusion of treatment**
  o Reassess sensation
  o Reassess pulses
  o Reassess insertion site and securing devices/sutures

  Note: If any changes to insertion site, bleeding in IABP tubing, or changes in pulses or sensation, notify physician immediately.
  Obtain Chest Xray to ensure appropriate positioning of the pump as determined by HF team.

- If CXR showing significant migration (either side of aortic notch) then floor team to call covering Heart Failure attending or fellow.

- Heart Failure attending or fellow to determine if there is a need for IABP repositioning or other action.

**Patient Definitions:**
IABP; Intra-aortic Balloon Pump
ROM; Range Of Motion
RW; Rolling Walker