Mobilizing Percutaneously Placed Axillary-Subclavian Intra-Aortic Balloon Pump Pre-Heart Transplant Patients

A Retrospective Study

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Refractory advanced heart failure patients have limited treatment options while awaiting transplantation.

- Pharmacologic Therapies
  - Inotropes (including home Milrinone and Dobutamine)
  - Optimization of oral medications
- Temporary Mechanical Supportive Devices
  - Intra-Aortic Balloon Pump (IABP) Therapy
  - Left Ventricular Assist Device as bridge to transplant
    - Percutaneous (Impella, Tandem Heart)
    - Surgical (Heart Mate II, Heartware)
Intra-Aortic Balloon Pump

- Common treatment for acutely decompensated end stage heart failure patients with hypo-perfusion
- Traditionally percutaneously inserted via femoral artery
- Mandatory bedrest with minimal movement of affected extremity, HOB lowered <30 degrees
- Risks for multiple complications
Intra-Aortic Balloon Pump

- Complications of Femorally Inserted IABP
  - Impaired mobilization \((\text{Goldich et al., 2011})\)
  - Increased risk of infection \((\text{Gjesdal et al., 2009})\)
  - Increased risk of vascular complications, including limb ischemia \((\text{Gjesdal et al., 2009})\)
  - Bleeding \((\text{Cochran et al., 2002})\)
  - Risk of skin breakdown and pressure ulcer formation \((\text{Assis et al., 2009})\)
• HMH Cardiologist developed technique for a Percutaneously Placed Axillary-Subclavian Intra-aortic Balloon Pump (PAIABP) (Estep et al., 2012)

• Percutaneously inserted via left axillary artery
  – Inserted in the cardiac catheterization lab under fluoroscopy
  – HMH first institution to implement this technique, only institution to use the technique routinely
  – Allows patients to be mobilized while awaiting heart transplantation
  – 87.5% Successful bridge to transplant (vs. 78% bridged by femoral and surgical trans-thoracic extended IABP support) (Estep et al., 2012)
• Risks for complications (femoral approach vs. PAIABP)
  – Increased risk of infection (30% vs. 0% for PAIABP) (Gjesdal et al., 2009) (Estep et al., 2012)
  – Increased risk of vascular complications, including limb ischemia (18.6% vs. 20% in PAIABP) (Gjesdal et al., 2009) (Estep et al., 2012)
  – Bleeding (4.6% - with extended IABP support vs. 4% for PAIABP) (Cochran et al., 2002) (Estep et al., 2012)
PAIABP Insertion Site

Trans-thoracic Placement

Fig 3. Positioning and fixation of the trans-thoracic intraaortic balloon pump in the descending thoracic aorta.
1. Describe that PAIABP therapy allows mobilization while awaiting transplantation.

2. Describe the impact of mobilizing PAIABP therapy patients awaiting cardiac transplantation on physical strengthening, post-cardiac transplant extubation time, post-transplant ICU LOS, and total post-transplant hospital LOS.

3. Describe PAIABP therapy rate of complications as compared with femoral IABP.

4. Discuss the effect of implementing new PAIABP technique on nursing care and interdisciplinary collaboration.
Patient progressed from requiring a rolling walker and maximum assist to a cane for ambulation prior to transplant.
Mobilization Measurement

• Functional Independence Measure (FIM)
  – Provides a uniform system of measurement based on the *International Classification of Impairment, Disabilities, and Handicaps*
  – Physical Therapy tool to measure disability in acute care settings by applying scores based on level of assistance with activity *(Keith, et al. 1987)*
  – Used to measure patient’s progress and assess rehabilitation outcomes
  – Complete scale useful in clinical settings of rehabilitation, are responsive to change and can reflect a patient’s discharge destination
### FIM Scoring

#### FIM Scoring Criteria:

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Complete Independence</td>
</tr>
<tr>
<td>6</td>
<td>Modified Independence (patient requires use of a device, but no physical assistance)</td>
</tr>
</tbody>
</table>

**Helper (Modified Dependence)**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Supervision or Setup</td>
</tr>
<tr>
<td>4</td>
<td>Minimal Contact Assistance (patient can perform 75% or more of task)</td>
</tr>
<tr>
<td>3</td>
<td>Moderate Assistance (patient can perform 50% to 74% of task)</td>
</tr>
</tbody>
</table>

**Helper (Complete Dependence)**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Maximal Assistance (patient can perform 25% to 49% of task)</td>
</tr>
<tr>
<td>1</td>
<td>Total assistance (patient can perform less than 25% of the task or requires more than one person to assist)</td>
</tr>
<tr>
<td>0</td>
<td>Activity does not occur</td>
</tr>
</tbody>
</table>

Activities of Daily Living
FIM Scoring

- Items are scored based on the level of assistance required for an individual to perform activities of daily living
- Complete scale includes 18 items (13 items – physical domains and 5 items – cognitive domains)
- Each item is scored from 1 to 7 based on level of independence (1=Total Dependence and 7=Complete Independence)
Weekend Getaway

Two of our PAIABP patients on a weekend trip to our Healing Garden
Methodology

• Design: Retrospective Descriptive Study
• Sample: Adult PAIABP therapy patients awaiting cardiac transplantation in the Coronary Intensive Care Unit (CICU) from January 2007 to May, 2013
• Patient selection
  – Inclusion criteria
    ▪ Adult patients age 18-85 years
    ▪ Diagnosis of end-stage heart failure (NYHA class IV)
    ▪ PAIABP in place
    ▪ Placed on cardiac transplant list
  – Exclusion criteria
    ▪ Mechanical ventilation
    ▪ Lower extremity paralysis
• Statistical Analysis
  – Data are presented as mean (standard deviation) for continuous variables and number (percentage) are reported for categorical variables.
  – Ordinal logistic regression and generalized estimating equations (GEE) models from longitudinal data analysis were used to model the time effects on all outcome variables.
  – All analyses were performed with STATA version 13 (StataCorp, College Station, TX).
  – Statistical significance was defined as a two-tailed P <0.05 for all tests.
Data Collection

- Demographic Data
- Vital Signs collected every 12 hours
- Daily review of activity (including RN and PT documentation)
  - PT visit data converted to FIM Score
- Review of documented complications
- Monitored post-operative recovery
  - FIM score for post-operative activity
  - Post-operative time to extubation
  - Post-operative ICU and hospital LOS
Total of 45 patients met inclusion and exclusion criteria

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>56 years (range 24-72, SD 10.71)</td>
</tr>
<tr>
<td>Gender</td>
<td>Male: 35 (77.8%) Female: 10 (22.2%)</td>
</tr>
<tr>
<td>BMI</td>
<td>27.9 (SD 4.97)</td>
</tr>
<tr>
<td>Race</td>
<td>Caucasian: 28 (62.2%) Black: 10 (22.2%) Hispanic: 5 (11.1%) Asian: 1 (2.2%) Other: 1 (2.2%)</td>
</tr>
<tr>
<td>Mortality</td>
<td>Survived: 36 (81.8%) Deceased: 8 (18.2%)</td>
</tr>
</tbody>
</table>
# FIM Score Results

Pre-PAIABP (home data) compared to Post-PAIABP (CICU Data)

<table>
<thead>
<tr>
<th>Factor’s Relationship With Time</th>
<th>FIM Score Range</th>
<th>Coefficient</th>
<th>95% Confidence Interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer</td>
<td>2-7</td>
<td>-0.91</td>
<td>(-1.30, -0.50)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Gait</td>
<td>3-7</td>
<td>-1.03</td>
<td>(-0.136, -0.50)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Distance</td>
<td>200-2000 ft.</td>
<td>6.82</td>
<td>(4.27, 9.38)</td>
<td>&lt;.001</td>
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<tr>
<td>Device</td>
<td>4-7</td>
<td>1.17</td>
<td>(0.81, 1.53)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
FIM Score Results

Post-PAIABP (CICU data) Compared to Post-Transplant Data

<table>
<thead>
<tr>
<th>Factor’s Relationship With Time</th>
<th>FIM Score Range</th>
<th>Coefficient</th>
<th>95% Confidence Interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer</td>
<td>1-7</td>
<td>0.99</td>
<td>(.49, 1.50)</td>
<td>&lt;.001</td>
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<tr>
<td>Gait</td>
<td>2-7</td>
<td>0.73</td>
<td>(.20, 1.26)</td>
<td>.01</td>
</tr>
<tr>
<td>Distance</td>
<td>5-400 ft.</td>
<td>3.03</td>
<td>(1.75, 4.32)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Device</td>
<td>4</td>
<td>0.81</td>
<td>(-.02, 1.65)</td>
<td>.06</td>
</tr>
</tbody>
</table>
## FIM Score Results

### Post-PAIABP FIM Scores per PT Session

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FIM - 1\textsuperscript{st}</strong></td>
<td>26</td>
<td>3</td>
<td>7</td>
<td>4.81</td>
<td>.895</td>
</tr>
<tr>
<td><strong>FIM - 2\textsuperscript{nd}</strong></td>
<td>23</td>
<td>4</td>
<td>7</td>
<td>5.26</td>
<td>1.096</td>
</tr>
<tr>
<td><strong>FIM - 4\textsuperscript{th}</strong></td>
<td>12</td>
<td>3</td>
<td>6</td>
<td>4.58</td>
<td>.793</td>
</tr>
<tr>
<td><strong>FIM - 6\textsuperscript{th}</strong></td>
<td>7</td>
<td>3</td>
<td>7</td>
<td>4.71</td>
<td>1.604</td>
</tr>
<tr>
<td><strong>Valid N (listwise)</strong></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>
## Impact of Mobilization

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Range</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Transplant PAIABP Days</strong></td>
<td>24.98</td>
<td>2-147</td>
<td>25.03</td>
</tr>
<tr>
<td><strong>Total PAIABP Days</strong></td>
<td>27</td>
<td>4-182</td>
<td>29</td>
</tr>
<tr>
<td><strong>Post-Transplant ICU Day</strong></td>
<td>7</td>
<td>2-21</td>
<td>5</td>
</tr>
<tr>
<td><strong>Post-Transplant LOS</strong></td>
<td>22.38</td>
<td>8-110</td>
<td>17.87</td>
</tr>
<tr>
<td><strong>Total LOS</strong></td>
<td>58.35</td>
<td>21-259</td>
<td>43.53</td>
</tr>
<tr>
<td><strong>Time (hours) to Extubation</strong></td>
<td>61.74</td>
<td>2.75-363.75</td>
<td>88.59</td>
</tr>
</tbody>
</table>
Walking to the OR

One of our PAIABP patients who insisted on WALKING to the OR for his heart transplant!
• **Average Activity**
  - Mobilized 2 times daily
    - Time to initial mobilization post-PAIABP ± 1.3 days
  - Ambulated a maximum of 3 times daily
    - Ambulated on average QOD (mobilized ± 2/day)
  - Distance - mean 1205 ft.
    - Documented range - 2-9980 ft.
  - Patients requiring rolling walker decreased from 31.9% to 10.6% after 6 PT sessions
  - Only 58.7% of patients required a rolling walker on first PT session after transplantation
  - Decrease in FIM Score statistically significant when compared to pre-hospitalization activity level
Complications

- Minimal complications of limb ischemia (7%)
- No reported incidence of pressure ulcer formation (0%)
- One incidence of line infection (2%)
- Higher PAIABP related mal-position/need for exchange (Estep et al., 2012)
  - Required additional CXR’s and trips back to cardiac catheterization lab, as well as bedside PAIABP placement manipulation
  - Includes catheter migration, mal-function, kinking or rupture, and arterial injury
Nursing Care

• Activity
  – Physical Therapy consulted to evaluate patient, assist with mobility
  – Initial in-room activity (ex: OOB to chair) with assist
  – Independence increases as patient strengthening and familiarity with lines/wires improves, Patient OOB to chair and bathroom without assist allowed
  – Ambulation in unit and around 10th floor, always with RN (Portable monitoring and IABP on battery power). May need additional assistance of Physical Therapy, PCA’s as indicated. Often family members are recruited to help push IV poles, wheelchairs, etc.
    ▪ More stable patients are monitored on IABP console only during ambulation
    ▪ Stronger patients push their own IV poles and IABP consoles
Nursing Care

• IV Infusions
  – Most common IV medications are Heparin and Milrinone
  – Heparin rates are determined by either AntiXA levels or PTT levels
    ▪ Once therapeutic, may be only drawn MWF
    ▪ Trained PharmD is responsible for dosing titration
  – Monitoring vital signs may be difficult due to frequent position change, resulting in difficulty keeping transducer leveled

• Dressings
  – Sterile CHG dressing changes per policy (Qweek), and as needed
  – Stat-Loc anchors and additional tegaderms used to secure PAIABP
  – Bleeding complications managed with Surgicel, Syvek and heparin titration
Nursing Care

• Pain Control
  – Most common complaints of pain are from insertion site and left arm/shoulder pain
  – Heating pads, analgesic ointment (Lidoderm patches or NTG paste to increase perfusion), pain medications used
  – Numbness and tingling in left arm have also been reported (nerve pain and decreased perfusion)
Additional Problems/Complications/Findings

- Noted incidence of IABP rupture, migration, clotted arterial lines, catheter kinking
- Two episodes of complications while ambulating outside unit
  - Episode of VT, patient able to return to unit
  - Battery malfunction, pump powered off during ambulation off unit
- Initial high level of staff anxiety about ambulation of PAIABP patients
  - Concern over monitoring patient during ambulation
  - Difficulty in disconnecting and reconnecting patient from the monitors
- Education of other staff and departments about new procedure
• Additional Findings
  – Long wait times resulted in staff and patients/families building strong relationships, celebrating holidays and special occasions together.
Nursing Care

- Sense of support AND competition among patients and family members. At one time we had 5 patients in the unit awaiting heart transplantation. They visited each other regularly, followed each other’s progress, and became a great support system for the patients and families.
Implications for Practice

• Nursing EBP, improvisation and ingenuity
  – Required extensive interdisciplinary collaboration and education

• New protocols for a new procedure
  – Distance/location restrictions
  – Ability of RN to ambulate patient without a Perfusionist
  – Increased strengthening resulted in decreased need for PT assistance/support over time
  – Schedule allowances to allow overnight sleep

• Staff initial resistance/hesitation to mobilizing these patients
  – Initially required a large amount of staff, time, and resources (included RN, PT, Perfusionist and ancillary staff)
  – Required education for our Physician staff
Conclusions

• Physical therapy and mobilization prior to heart transplantation in patients receiving PAIABP therapy resulted in a decrease in activity assistance post-operatively.

• Mobilization of PAIABP patients was shown to have a low rate of complications and is now considered a safe practice, and routine to be implemented prior to transplantation in our institution.

• Patients are at an increased risk for complications, including impaired mobility, when they are admitted to the hospital.
Ambulating in CICU
Heart was weak, but father’s love strong enough

By Anita Hassan

Timothy Lewis saved up two days worth of strength to make the 40-foot trek.

Saturday was his daughter’s wedding day, and nothing would stop him from walking her down the aisle — not the fact that he is confined to a hospital, not the weakness in his body from a failing heart, not even the bulky device keeping him alive.

Determined to have her father at the wedding, 24-year-old Lolaycia Lewis moved the date up more than three months and changed the location. On Saturday, what was supposed to be a large affair involving months of planning in her family’s hometown of Jackson, Miss., became a more intimate wedding with fewer than 20 people in a small chapel at Houston Methodist Hospital.

“She decided to move the date up for me,” the bride’s 48-year-old father said from a wheelchair in the hospital lobby, waiting for her to arrive. “She insisted that I be a part of their wedding.”

On Dec. 3, Timothy Lewis, who suffers from end-stage congestive heart disease, traveled from his home in Jackson to Houston Methodist, where he’d been seeing a cardiologist. His doctors admitted him immediately, determining that he needed a heart transplant to survive.

“His heart function was extraordinarily weak,” said Dr. Jerry Estep, medical director of the...
Ambulating in CICU
References


Acknowledgements

Dr. Shannan Hamlin, PhD, RN, ACNP-BC, AGACNP-BC, CCRN

CICU Staff, Houston Methodist Hospital

Dr. Jaya Paranilam, PhD

Dr. David Putney, Pharm D

Dr. Kevin Donahue, Pharm D
Ambulating in CICU
Left Axillary IABP Implant Technique

- Sterile preparation of the left subclavian-axillary and brachial or femoral region

- **Step 1** - 4 F arterial sheath (Avanti 11 cm 0.035”) used for initial access

- **Step 2** - J-guide wire (using fluoroscopy) inserted through this sheath and used to roadmap or identify the left axillary-subclavian

- **Step 3** - Direct axillary artery puncture using a micro puncture (Vaxcel™ Mini Stick™ kit) or standard percutaneous needle (AMC/4 18ga x 2 3/4”)
Left Axillary IABP Implant Technique

- **Step 4** - 4F sheath placement and limited axillary artery sheathogram to ensure patency

- **Step 5** - Exchange 4 F sheath for a 7.5 F IABP sheath

- **Step 6** - IABP placement over the wire and positioned a few centimeters beneath the level of the aortic arch (Maquet Getinge Group IABP balloon catheters/Datascope™ IABP consoles)