Describe the current landscape for transcatheter cardiovascular therapies for high risk patients
• Transcatheter aortic valve replacement
• Transcatheter mitral valve repair/replacement
• Transcatheter left atrial appendage occlusion

Review evidence-based best practice in patient evaluation and case selection of these therapies.

Discuss clinical pathways and implications for nursing care and discharge planning.

Begin to explore and apply these best practices using vignettes and case studies.

OBJECTIVES

UW REGIONAL HEART CENTER

• WWAMI’s only quaternary cardiac center
• The only hospital in the region to be selected for several landmark trials, including the PARTNER trial for transcatheter aortic valve replacement (TAVR)
• National and international experts in complex coronary artery disease, heart failure, structural and valvular heart disease, and adult congenital heart disease
TRANSCATHETER CARDIOVASCULAR THERAPIES: STRUCTURAL HEART SERVICES

- Catheter-based intervention
- Hybridization of specialties
- Current emphasis is transcatheter aortic valve replacement (TAVR)
- Scope of and roles within this subspecialty will continue to evolve in the context of the Heart Team

PREDECESSORS OF THE HEART TEAM

- Oncology Tumor Board
- Transplant Team
- Syntax Trial CABG vs. PCI
- PARTNER Trial CoreValve Pivotal Trial TAVR vs. SAVR TAVR vs. Medical Therapy

HISTORICAL PERSPECTIVE
MULTI-SOCIETY RECOMMENDATIONS, GUIDELINES, BEST PRACTICE

Published Jointly in:

J. Thorac Cardiovasc Surg
Ann Thorac Surg
J. Am Coll Cardiol
Catheter Cardiovasc Interv

J. Thorac Cardiovasc Surg 2012; 143:1254-63

Multisociety (AATS, ACCF, SCAI, and STS) expert consensus statement:
Operator and institutional requirements for transcatheter valve repair and replacement, part 1: Transcatheter aortic valve replacement

Carl L. Tommaso, MD,a R. Morton Bolman III, MD,b Ted Feldman, MD,c Joseph Barvaria, MD,d Michael A. Acker, MD,d Gabriel Aldea, MD,e Duke E. Cameron, MD,f Larry S. Dean, MD,e Dave Fullerton, MD,g Ziyad H. Hijazi, MD,h Eric Horlick, MD,I D. Craig Miller, MD,j Marc R. Moon, MD,k Richard Ringel, MD,f Carlos E. Ruiz, MD, PhD,l Alfredo Trento, MD,m Bonnie H. Weiner, MD,n and Evan M. Zahn, MD,o

HEART TEAM

Interventional Cardiology
Cardiac Surgery
Imaging
Echocardiology
CT Radiology
RN/ARNP Coordinator

Source: Adapted from Sandra Lauck, Why the Heart Team Matters, London Valve 2013.
THE REAL HEART TEAM

FRAMEWORK

UW Medicine Patients Are First.
Is our framework for organizational development.
Working together to achieve consistent service excellence for every patient, every time, is our key focus.

GOALS, MOTIVATION, AND QUALITY OF LIFE

Kansas City Cardiomyopathy Questionnaire (KCCQ-12)
The following questions refer to your heart failure and how it has affected your life. Please read and complete the following questions. There are no right or wrong answers. Please mark the answer that best applies to you.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Completely Limited</th>
<th>Moderately Limited</th>
<th>Slightly Limited</th>
<th>Not at all Limited</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Showering/bathing</td>
<td>O O O O O</td>
<td>O O O O O</td>
<td>O O O O O</td>
<td>O O O O O</td>
</tr>
<tr>
<td>b. Walking 1 block on level</td>
<td>O O O O O</td>
<td>O O O O O</td>
<td>O O O O O</td>
<td>O O O O O</td>
</tr>
<tr>
<td>c. Hurrying or going up stairs (on flat surface)</td>
<td>O O O O O</td>
<td>O O O O O</td>
<td>O O O O O</td>
<td>O O O O O</td>
</tr>
</tbody>
</table>

UW Medicine

CCS CLASS ANGINA

CLASS | DESCRIPTION
--- | ---
I | Angina with strenuous, rapid, or prolonged exertion
II | Slight limitation of ordinary activity such as walking, climbing stairs rapidly, walking or standing after meals in cold and in wind or under emotional stress
III | Marked limitation of ordinary physical activity. Walking 1-2 blocks on the level and climbing a flight of stairs under normal conditions
IV | Inability to carry out any physical activity without discomfort; Angina may be present at rest

UW Medicine
### CHF NYHA CLASSIFICATION

<table>
<thead>
<tr>
<th>CLASS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>No limitation of physical activity. Ordinary physical activity does not cause undue breathlessness, fatigue or palpitations.</td>
</tr>
<tr>
<td>II</td>
<td>Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in undue breathlessness, fatigue or palpitations.</td>
</tr>
<tr>
<td>III</td>
<td>Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity results in undue breathlessness, fatigue or palpitations.</td>
</tr>
<tr>
<td>IV</td>
<td>Unable to carry on any physical activity. Symptoms at rest can be present. If any physical activity is undertaken, discomfort is increased.</td>
</tr>
</tbody>
</table>

### HEART TEAM DECISION MAKING IN HIGH RISK PATIENTS

- **Pre-Screening**
  - Patients referred by primary care physicians or other healthcare providers
- **Heart Team Consultation**
  - Functional Assessment
  - Electrocardiogram (ECG)
  - Chest X-ray
  - Non-invasive testing
- **Diagnosis Evaluation**
  - Heart Team Decision
- **Heart Team-Driven Research**

### EVALUATION TIMELINES

- **24 hours**
  - Patient/MD contacted
  - Standard studies locally
  - Records/pre-auth initiated
- **30 days**
  - CTA + consult w/ ARNP, CTS, IC
  - Additional workup: TEE, CPT
- **44 days**
  - Patient treated
  - Within 30 days: Patient seen or other appropriate action taken
COMPLEX, COLLABORATIVE EVALUATION

Cardiac echo
Cardiac and femoral CT
Angiogram or functional study
Nursing Functional/Cognitive Assessment
Multidisciplinary Team Evaluation
Cardiologist consult
Surgical consults
PFTs Cardil U5

COMPLEX COORDINATION OF CARE

Patient and Family Education
Clinical Triage
Case Selection
Authorization and Reimbursement
Alignment of Multiple Specialties and "Silos"
Program Evaluation
Patient Assessment
Research Coordination
Waitlist Management
Data Collection/Tracking
Diagnostic Work-Up Coordination
Development of Program Forms
Waitlist Management
Communication With Referral Base
Follow-Up Evaluation
Program and Process Set-Up
Implementation of Standardized Orders
Dietary Management
Research Coordination
Data Collection/Tracking
Program and Process Set-Up
Implementation of Standardized Orders

TREATMENT OPTIONS BASED ON RISK

Surgery
SURGERY vs. STUDY FOR CATHETER BASED APPROACH
CATHETERS BASED APPROACH
LOW RISK STS < 4%
MODERATE RISK STS 4-8%
HIGH RISK STS > 8% or combined M&M 15%
PROHIBITIVE RISK STS > 10% / anatomy / or combined M&M 50%
UTILITY FUTILITY
MEDICAL MGMT PALLIATIVE CARE
EVALUATION OF PROCEDURAL RISK

DEFINING “FRAILTY”

- Same age (90) and predicted risk (12%) => who passes the eyeball test?
- Frailty is a syndrome of impaired physiologic reserve and decreased resistance to stressors
- Important estimate of overall health status and an arbiter of decision-making

ASSESSING FRAILTY

<table>
<thead>
<tr>
<th>“Eyeball Test”</th>
<th>Purely subjective assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gait Speed/15 foot walk</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>Height ≤ 173 cm</td>
</tr>
<tr>
<td>Men</td>
<td>Height ≥ 173 cm</td>
</tr>
<tr>
<td>Women</td>
<td>Height ≤ 159 cm</td>
</tr>
<tr>
<td>Women</td>
<td>Height ≥ 159 cm</td>
</tr>
<tr>
<td>Hand Grip</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>Frailty cutoff (Kg)</td>
</tr>
<tr>
<td>BMI 24.1 – 28</td>
<td></td>
</tr>
<tr>
<td>BMI &gt; 28</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td></td>
</tr>
<tr>
<td>BMI &gt; 23</td>
<td></td>
</tr>
<tr>
<td>Serum Albumin</td>
<td></td>
</tr>
<tr>
<td>&lt; 3.5 mg/dl</td>
<td></td>
</tr>
<tr>
<td>Katz Activities of Daily Living</td>
<td></td>
</tr>
<tr>
<td>6 = full function</td>
<td></td>
</tr>
<tr>
<td>4 = moderate impairment</td>
<td></td>
</tr>
<tr>
<td>0 = severe functional impairment</td>
<td></td>
</tr>
<tr>
<td>Layton Brody Instrumental Activities of Daily Living</td>
<td></td>
</tr>
<tr>
<td>8 = full function</td>
<td></td>
</tr>
<tr>
<td>&lt; 6 = impaired</td>
<td></td>
</tr>
</tbody>
</table>
• Severe AS with Class II CHF, BAV 6/2012 now with recurrent severe AS
• ICM and valvular cardiomyopathy EF 35% from 45% as of 3/2014
• IWMI 1995 s/p CABG (LIMA to LAD; SVG to diagonal; SVG to OM1, OM2; SVG to PDA)
• S/P carotid-subclavian bypass 7/11/2012 due to occluded SCL stent => now filling patent LIMA to LAD
• S/P PCI DES SVG to diagonal 6/2012
• PVD s/p L-fem pop bypass and R femoral stent
• CVA 2009 no residual defects s/p L carotid endarterectomy
• DVT w/IVC filter in place
• PAF on warfarin for above as well
• Moderate COPD

RISK PROFILE

Excessive risk due to RV adherent to sternal table and comorbidities; seen by CTS David Nelson, Gabriel Aldea, Nahush Mokadam

PFTs:      Carotid US:
FEV1  1.7L 56% pred   LICA 1-15% stenosis
DLCO 65% pred   RICA 50% stenosis

Frailty index Frail? NO
ADLs: 24/6 6/6
Grip > 18F/30M 41.7 kg
5MWT < 7 sec 4.9 sec
Albumin > 3.6 4.2 mg/dL
# Met 0/4

AS ASSESSMENT: 12/13/13

Echo:  
Trileaflet valve Y
Peak Transmural Vel 3.6 m/s
Mean transmural Grad 32 mmHg
Calculated EOA 1.2 cm2
Calculated iEOA (BSA) 0.6
Severity of AR Mild
Severity of MR Mild
Ejection Fraction 38%
TTE annulus diameter 23 mm
BSN
ANNULAR MEASUREMENT

<table>
<thead>
<tr>
<th>Annulus by CT</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Annulus Diameter</td>
<td>22.1</td>
</tr>
<tr>
<td>Long Annulus Diameter</td>
<td>25.4</td>
</tr>
<tr>
<td>Annular Area</td>
<td>448 mm²</td>
</tr>
<tr>
<td>% Area Oversizing</td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
</tr>
</tbody>
</table>

Aortic Root by CT  Measure

LVOT calcification  Moderate
Sinus of Valsalva Diameter  30.3 x 34.9
Sinotubular Junction Diameter 32.1 x 34.7
Left Coronary Height  14 mm
Right Coronary Height  12.7 mm

AORTIC COMPLEX

CARDIAC CATHETERIZATION 4/25/14

<table>
<thead>
<tr>
<th>Left Heart</th>
<th>Right Heart</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV 132/15</td>
<td>RA mean 8</td>
</tr>
<tr>
<td>Ao 85/46/60</td>
<td>RV 30/4</td>
</tr>
<tr>
<td>AV mean 45 mmHg</td>
<td>PA 29/12/18</td>
</tr>
<tr>
<td>AVA 0.7 cm²</td>
<td>PCWP 10</td>
</tr>
<tr>
<td>CO/CI (TD)</td>
<td>5.2/2.8</td>
</tr>
</tbody>
</table>

% stenosis  Location  Graft  % graft stenosis
LM 0%  Prox  LIMA to LAD
LAD 50%  High 1st diagonal  LIMA to LAD  Not eval
LAD 70%  High 2nd diagonal  SVG to diagonal
LCx 100%  OMs  SVG to OM  100%
RCA 100%  Ostial  SVG to PDA  100%
**ACCESS CTA**

[Image of ACCESS CTA]

**SUMMARY**

- **STS:** 7% (underestimated)
- **Patient Cohort:** Excessive Risk
- **Key Risk Contributors:**
  - Prior sternotomy; RV adherent to sternal table; comorbidities
- **Access:** Transapical
- **Echocardiography:**
  - AVA: 1.2 cm²
  - Mean gradient: 3 mmHg
  - AV velocity: 3.6 m/s
  - EF: 38%
- **Planned Valve Size:** 26 mm XT
- **CT Annular Measurements:**
  - Area: 448 mm²
  - Diameters: 22 x 25
  - % Oversizing
- **Procedural Considerations:**
  - Known CAD
  - Known PAD
  - Backup bypass plan

**AORTIC STENOSIS**

[Images of aortic valve specimens]

Images courtesy of Renu Virmani MD at the CVPath Institute

LWMedicine
AORTIC STENOSIS

- Prevalence of up to 7% of adults > 65 yrs
- If untreated, 50% of patients with severe symptomatic AS die in 1-2 years
- 40% of patients with severe symptomatic AS do not undergo surgery

AORTIC STENOSIS IS LIFE THREATENING AND PROGRESSES RAPIDLY

- Survival after onset of symptoms is 50% at 2 years
- Surgical intervention for severe aortic stenosis should be performed promptly once even minor symptoms occur

PARTNER TRIAL

© University of Washington School of Nursing - UWCNE.ORG
As seen previously, survival after onset of symptoms in patients with aortic stenosis is 50% at 2 years. The PARTNER Trial showed that in inoperable patients with severe aortic stenosis who did not receive a valve replacement, 50% died within 1 year. Despite the frequent utilization of BAV, standard therapy did not do much to alter the dismal course of disease for inoperable patients with severe aortic stenosis.

STANDARD THERAPIES ARE INADEQUATE TREATMENTS FOR SEVERE AS

As seen previously, survival after onset of symptoms in patients with aortic stenosis is 50% at 2 years. The PARTNER Trial showed that in inoperable patients with severe aortic stenosis who did not receive a valve replacement, 50% died within 1 year. Despite the frequent utilization of BAV, standard therapy did not do much to alter the dismal course of disease for inoperable patients with severe aortic stenosis.

COREVALVE US PIVOTAL TRIAL

The PARTNER Trial

STANDARD THERAPIES ARE INADEQUATE TREATMENTS FOR SEVERE AS

 COREVALVE US PIVOTAL TRIAL

The PARTNER Trial

FDA APPROVED THERAPIES FOR HIGH RISK PATIENTS WITH CALCIFIC AS

FDA APPROVED THERAPIES FOR HIGH RISK PATIENTS WITH CALCIFIC AS
TRANSFEMORAL BALLOON EXPANDABLE THV

http://www.youtube.com/watch?v=IQDVNPdEC0U

LW Medicine

BALLOON AORTIC VALVULOPLASTY

LW Medicine

SHEATH INSERTION

LW Medicine
TRACKING THE DELIVERY SYSTEM OVER THE AORTIC ARCH

EDWARDS SAPIEN TRANSCATHETER HEART VALVE DEPLOYMENT

ALTERNATIVE OPTIONS FOR PATIENTS WITHOUT VASCULAR ACCESS

http://www.edwards.com/products/transcathetervalve/Pages/THVcategory.aspx
THERAPIES IN CLINICAL TRIAL AT UWMC

Sapien 3
14F sheath
THV 23-29 mm

Q2 2014
PARTNER TRIAL
S3I Cohort
Intermediate Risk

Sapien XT
18F sheath
THV 23-29 mm

Q2 2014
PARTNER TRIAL
VIV Cohort
Inoperable/Excessive Risk

Sapien XT
18F sheath
THV 20 mm

Q3 2014
PARTNER TRIAL
Inoperable/High Risk

TAVR ESTIMATED AVERAGE PENETRATION

POPULATION:
14 million

POPULATION > 65 YRS:
1.9 million

ESTIMATED AS PREVALENCE (7%):
133,000

EUROPEAN PENETRATION:
Germany pop. 83 million
8,000 TAVR or 100 cases per million

ESTIMATED AVG TAVR CASES IN WWAMI/OR
1400 cases per year

TAVR IN THE WWAMI/OR REGION
MITRAL REGURGITATION

- Most common type of heart valve insufficiency in US
- Approximately 4 million people have significant mitral valve insufficiency
- Annual incidence of 250,000 people
- Approximately 50,000 of these patients undergo surgery each year in the United States, or 20% of patients
- Up to 60% of patients do not undergo surgery

MITRAL REGURGITATION

- PRIMARY MR: Valve problem
- SECONDARY MR: Ventricle problem
MITRACLIP = ALFIERI STITCH

COAPTATION ZONE

MITRACLIP ANIMATION
90% of strokes from the LAA in non-valvular AF

70% of strokes from the LAA in valvular AF

Highest risk of stroke in those with highest risk of bleeding on warfarin

MITRACLIP
Non-surgical treatment for leaky hearts

ATRIAL FIBRILLATION AND THROMBOEMBOLIC EVENTS

90% of strokes from the LAA in non-valvular AF

70% of strokes from the LAA in valvular AF

Highest risk of stroke in those with highest risk of bleeding on warfarin
UBIQUITOUS ANATOMY

MYRIAD DEVICES PENDING FDA APPROVAL AND CLINICAL TRIAL

REACHING THE IDEAL

A 97 year old woman discharged the same day after a TAVR procedure stretching while waiting for the bus to get home... read more on page 3.
IMPACT OF PROCEDURAL APPROACH

<table>
<thead>
<tr>
<th></th>
<th>LOS</th>
<th>DC HOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANSAPICAL/ALTERNATE ACCESS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PARTNER A</td>
<td>15</td>
<td>NR</td>
</tr>
<tr>
<td>MEDPAR FY12</td>
<td>10</td>
<td>23%</td>
</tr>
<tr>
<td>STS/ACC TVT INOPERABLE</td>
<td>8</td>
<td>57%</td>
</tr>
<tr>
<td>STS/ACC TVT HIGH RISK</td>
<td>8</td>
<td>55%</td>
</tr>
<tr>
<td>TRANSFEMORAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PARTNER A</td>
<td>10</td>
<td>NR</td>
</tr>
<tr>
<td>MEDPAR FY12</td>
<td>8</td>
<td>33%</td>
</tr>
<tr>
<td>STS/ACC TVT INOPERABLE</td>
<td>5</td>
<td>70%</td>
</tr>
<tr>
<td>STS/ACC TVT HIGH RISK</td>
<td>5</td>
<td>67%</td>
</tr>
<tr>
<td>VANCOUVER</td>
<td>1.8</td>
<td>96%</td>
</tr>
</tbody>
</table>

Please Note*
The speaker ended her live presentation at this slide. Feel free to continue reviewing the handout for self study purposes.

Thank you for viewing this Nursing Grand Rounds!

LIVE PRESENTATION

85% in hybrid room
98% with general anesthesia
64% transfemoral
63% cutdown => 71% INOPERABLE
Patient Selection and Risk Stratification

Procedural Approach, Imaging, and Site Expertise

Standardized Education, Expectations, and Practice

IMPACT ON LENGTH OF STAY

LOW RISK FOR TAVR

HIGH RISK FOR SAVR

PATIENT SELECTION AND RISK STRATIFICATION

PERI-PROCEDURAL RISK

Cardiac Function
Pulmonary Disease
Renal Function
Frailty/Cognition/Nutrition

Risk for Procedure

Implant Access
Access and Approach

LW Medicine
DEFINING LEVELS OF RISK

<table>
<thead>
<tr>
<th>Access</th>
<th>LOW</th>
<th>MODERATE</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach</td>
<td>Percutaneous</td>
<td>Percutaneous or cutdown</td>
<td>Cutdown</td>
</tr>
<tr>
<td>Implant Anatomy</td>
<td>Excellent</td>
<td>Favorable with team/planning</td>
<td>Significant concerns</td>
</tr>
<tr>
<td>Ventricular Function</td>
<td>Normal LV &amp; RV</td>
<td>Reduced LV &amp; RV</td>
<td>LV &lt; 40% and RV dysfunction</td>
</tr>
<tr>
<td>Other VHD/Pulmonary HTN</td>
<td>None</td>
<td>Other VHD, moderate PHTN</td>
<td>MS, severe MR/TR pulmonary HTN</td>
</tr>
<tr>
<td>Pulmonary Disease</td>
<td>None to moderate</td>
<td>Moderate to severe</td>
<td>Severe</td>
</tr>
<tr>
<td>Renal Function</td>
<td>Normal eGFR</td>
<td>eGFR 40-60</td>
<td>eGFR &lt; 40</td>
</tr>
<tr>
<td>Frailty/cognition/ nutrition</td>
<td>Normal</td>
<td>Any marker of frailty</td>
<td>Any dementia, extreme BMI</td>
</tr>
</tbody>
</table>

IMPACT ON LENGTH OF STAY

<table>
<thead>
<tr>
<th>Risk Stratification for Procedural Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure, Imaging, and Site Expertise</td>
</tr>
<tr>
<td>Standardized Education, Expectations, Tracts</td>
</tr>
<tr>
<td>Patient Selection and Risk Stratification</td>
</tr>
</tbody>
</table>

RISK STRATIFICATION FOR PROCEDURAL PLANNING

<table>
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<td>Procedure, Imaging, and Site Expertise</td>
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<tr>
<td>Patient Selection and Risk Stratification</td>
</tr>
</tbody>
</table>

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IMPLEMENTING A RISK-STRATIFIED TAVR CLINICAL PATHWAY

IMPACT ON LENGTH OF STAY

STANDARDIZE EDUCATION AND EXPECTATIONS
STANDARDIZE THE PRACTICE

TRANSFEMORAL FAST-TRACK PATHWAY

ALTERNATE ACCESS CLINICAL PATHWAY
THERE IS AN APP FOR THAT…

SUCCESS STORIES IN OPTIMIZING LENGTH OF STAY

TIMELINES FOR EMERGING THERAPIES
80 YO W/SEVERE BIOPROSTHETIC AS, MOD-SEV DMR, AF AT HIGH RISK FOR ANTICOAGULATION

FUTURE CONSIDERATIONS FOR UWMC

Next-generation valves and new devices are coming to commercial market and clinical trial.

Uses and indications are expanding, while we learn who stands to benefit, and patients want a say.

Delivery catheters are getting smaller and arterial access is getting safer.

Imaging systems are becoming more sophisticated and serve to co-pilot in cases.

Efficiency and cost are more important than ever and expectations still be minimally invasive with rapid return to home, better than baseline.

SHARE SUCCESSES
UW SCHOOL OF NURSING #1 SINCE 1984

UW SCHOOL OF NURSING - UNIVERSITY OF WASHINGTON

Ranking & Achievements
Top-Rated Nursing School

UWMC – THE ONLY FIVE TIME MAGNET AWARD WINNER IN THE NATION

With 5 Magnet designations, UWMC is peerless in U.S.

US NEWS AND WORLD REPORT

#26 and first time in the Top 50 for Cardiology and Cardiac Surgery!
Patient-centered, Multidisciplinary Heart Team evaluation and treatment is the new paradigm for patient care

Clinical translation of cutting-edge catheter-based therapies requires evidence-based, standardization of protocols and pathways

Transcatheter cardiovascular therapies provides a unique opportunity for the contribution, recognition, and elevation of the pivotal profession of nursing

Thank you for your attention

Elizabeth Perpetua DNP APRN-BC CCRN
eperpetua@u.washington.edu