Introduction

Congenital heart disease is a term that means a person was born with heart problems. These difficulties affect the heart’s function and structure. Congenital heart disease can range from mild, which may not need treatment, to severe, which often does. One congenital heart defect is known as right ventricular outflow tract (RVOT) dysfunction. Essentially, it’s a problem with how the blood flows as it leaves the heart and goes to the lungs. Repairing it requires reconstructing certain areas of the heart and placing a tube (conduit) to allow the blood to flow correctly. Over a long period of time the conduit can become narrowed or a specific valve can become leaky. A second valve replacement surgery may be needed in this situation. This second surgery is usually done as an open surgery. However, surgery using a long, thin tube (a heart catheter) instead of open heart surgery can be done in certain situations. This policy describes when an additional RVOT surgery using a catheter may be considered medically necessary.

Note: The Introduction section is for your general knowledge and is not to be taken as policy coverage criteria. The rest of the policy uses specific words and concepts familiar to medical professionals. It is intended for providers. A provider can be a person, such as a doctor, nurse, psychologist, or dentist. A provider also can be a place where medical care is given, like a hospital, clinic, or lab. This policy informs them about when a service may be covered.
Service | Medical Necessity
--- | ---
Transcatheter pulmonary valve implantation (TPVI) | Transcatheter pulmonary valve implantation (TPVI), when performed according to FDA-approved indications, is considered medically necessary for patients with prior repair of congenital heart disease and right ventricular outflow tract (RVOT) dysfunction, who are not good candidates for open repair due to one or more of the following conditions:
- High-risk for surgery due to concomitant medical comorbidities
  OR
- Poor surgical candidate due to multiple prior thoracotomies for open heart surgery
  AND
- Moderate to severe pulmonary valve regurgitation
  OR
- Pulmonary valve stenosis, with mean (RVOT) gradient ≥ 35 mm Hg

Transcatheter pulmonary valve implantation is considered investigational for all other indications.

Coding

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>CPT</td>
<td></td>
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<tr>
<td>33477</td>
<td>Transcatheter pulmonary valve implantation, percutaneous approach, including pre-stenting of the valve delivery site, when performed</td>
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Evidence Review

Description

Transcatheter pulmonary valve implantation (TPVI) received approval from the U.S. Food and Drug Administration under a humanitarian device exception in January 2010 for patients with previous repair of congenital heart disease (CHD) and right ventricular outflow tract (RVOT) obstruction. Patients with prior CHD repair are at risk of needing repeated reconstruction procedures. TPVI has been proposed as a less invasive alternative to open surgical pulmonary valve replacement or reconstruction for RVOT obstruction.

Background

Description of Disease

Congenital heart disease, including tetralogy of Fallot, pulmonary atresia, and transposition of the great arteries, is generally treated by surgical repair at an early age. This involves reconstruction of the right ventricular outflow tract (RVOT) and pulmonary valve by means of a surgical homograft or a bovine-derived valved conduit. These repairs are prone to development of pulmonary stenosis or regurgitation over long periods of follow-up.

Because individuals who have had surgically corrected congenital heart disease are living longer into adulthood, RVOT dysfunction following initial repair has become more common. Calcification of the RVOT conduit can lead to pulmonary stenosis, while aneurysmal dilatation can result in pulmonary regurgitation. RVOT dysfunction can lead to decreased exercise tolerance, potentially fatal arrhythmias, and/or irreversible right ventricular dysfunction.¹

Interventions for RVOT dysfunction often require repeat open heart surgery, resulting in numerous open heart procedures for patients who live into adulthood. Treatment options for pulmonary stenosis are open surgery with valve replacement, balloon dilatation, or percutaneous stenting.¹ Interventions for pulmonary regurgitation are primarily surgical, either reconstruction of the RVOT conduit or replacement of the pulmonary valve through open surgery. The optimal timing of these interventions is not well understood.²
Transcatheter pulmonary valve replacement offers a potentially less invasive treatment option for patients with prior surgery for congenital heart disease and RVOT dysfunction. It is possible that the use of less invasive valve replacement techniques can spare patients from multiple repeat open heart procedures over long periods of follow-up.

**Description of Technology**

The Melody Transcatheter Pulmonary Valve (TPV) and the Ensemble Transcatheter Valve Delivery System are used together for percutaneous replacement of a dysfunctional pulmonary valve. The Melody valve consists of a section of bovine jugular vein with an intact native venous valve. The valve and surrounding tissue is sutured within a platinum-iridium stent scaffolding. The transcatheter delivery system consists of a balloon-in-balloon catheter with a retractable sheath and distal cup into which the valve is placed. The procedure is performed on the beating heart without use of cardiopulmonary bypass.

The Melody valve is first crimped to fit into the delivery system. It is introduced through the femoral vein and advanced into the right side of the heart and put into place at the site of the pulmonary valve. The inner balloon is inflated to open the artificial valve, and then the outer balloon is inflated to position the valve into place.

The Edwards Sapien XT Transcatheter Heart Valve (Pulmonic) (Edwards Lifesciences) and the NovaFlex + delivery system, composed of a stainless steel frame with bovine pericardial tissue leaflets and available in 23-mm, 26-mm, and 29 mm sizes and accessories, gained Food and Drug Administration approval under Investigational Device Exemption (IDE) for use in the United States in February of 2016.

**Summary of Evidence**

**FDA-Approved Device and Indication**

For individuals who have a history of congenital heart disease (CHD) and current right ventricular outflow tract (RVOT) obstruction who receive transcatheter pulmonary valve implantation (TPVI) with a Food and Drug Administration (FDA)-approved device and indication, the evidence includes 1 prospective, interventional, noncomparative study and multiple prospective and retrospective case series. Relevant outcomes are overall survival, symptoms, functional outcomes, quality of life, hospitalizations, and treatment-related morbidity and mortality. Results of the case series indicate that there is a high rate of procedural success and
low procedural mortality, although the rates of serious procedural adverse events reported ranges from 3.0% to 7.4%. Most valves demonstrate competent functioning by Doppler echocardiography at 6- to 12-month follow-up, but complications (eg, stent fractures, need for re-interventions) were reported in an FDA analysis to occur at rates of 18% and 7%, respectively. Other publications with longer follow-up have reported stent fractures in up to 26% of patients; however, most stent fractures have not required reintervention. Studies with follow-up extending to a maximum of 7 years postprocedure have suggested that the functional and hemodynamic improvements are durable, but a relatively high proportion of patients (20%-30%) require reintervention on the pulmonary valve. No comparative studies were identified, and there is no direct evidence that TPVI leads to a reduction in future open heart procedures. The evidence is insufficient to determine the effects of the technology on health outcomes.

According to Hayes, the available observational studies found generally consistent short-term benefits of TPVI for RVOT, with some results dependent on etiology and pathology of the pulmonary valve defect, operator experience, and procedure protocol. Most of the hemodynamic measures improved consistently across 22 observational studies. Only 6 observational studies evaluated pulmonary regurgitation, but they reported significant improvement from baseline; however, long-term pulmonary regurgitation severity remains unknown. Results from 11 observational studies were less consistent, with some showing significant improvements from baseline and others showing small improvements only. The TPVI procedure itself was technically successful in most cases, but reintervention was required in approximately 25% to 33% of patients at 5-year follow-up. Overall, TPVI was relatively safe, compared with open chest surgery; however, it has caused severe, potentially life-threatening complications. (Hayes, January 2017)

**Non-FDA-Approved Device or Indication**

For individuals who have a history of CHD and current RVOT obstruction who receive TPVI with a non-FDA-approved device or indication, the evidence includes case series. Relevant outcomes are overall survival, symptoms, functional outcomes, quality of life, hospitalizations, and treatment-related morbidity and mortality. There is currently limited published evidence on the off-label use of TPVI, including implantation of a non-FDA-approved valve, or use of an approved valve for a non-FDA-approved indication. The published relatively small case series are heterogeneous in terms of the device used and the indications for TPVI. The evidence is insufficient to determine the effects of the technology on health outcomes.
Ongoing and Unpublished Clinical Trials

Some currently unpublished trials that might influence this review are listed in **Table 1**.

### Table 1. Summary of Key Trials

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
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<tr>
<td><strong>Ongoing</strong></td>
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<tr>
<td>NCT00676689a</td>
<td>Implantation of the SAPIEN Transcatheter Heart Valve (THV) in the Pulmonic Position</td>
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<td>Nov 2019 ongoing but not recruiting</td>
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<td>NCT00740870a</td>
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<td>171</td>
<td>July 2020 ongoing but not recruiting</td>
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<tr>
<td>NCT02987387</td>
<td>Post-approval Study of the SAPIEN XT THV in Patients with Pulmonary Valve Dysfunction</td>
<td>191</td>
<td>Jan 2024</td>
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NCT: national clinical trial

a Denotes industry-sponsored or cosponsored trial

### Clinical Input Received from Physician Specialty Societies and Academic Medical Centers

While the various physician specialty societies and academic medical centers may provide appropriate reviewers who collaborate with and make recommendations during this process, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted.

In response to requests, input was received from 6 academic medical centers while this policy was under review in 2011. Overall response to whether TPVI was investigational was mixed, with 2 of 5 reviewers indicating they agree with the investigational status, and 3 reviewers who indicated partial support. Most reviewers (4/5) indicated that there is a subpopulation of patients who are at high risk for surgery or who are not candidates for surgery, and for whom there are no other available options. These reviewers felt TPVI was a viable alternative that offered potential benefit for these patients.
Practice Guidelines and Position Statements

*Society for Cardiovascular Angiography and Interventions et al*

In 2015, the Society for Cardiovascular Angiography and Interventions, American Association for Thoracic Surgery, American College of Cardiology (ACC) and the Society of Thoracic Surgeons published a consensus-based report on operator and institutional requirements for TPVI. Recommendations to qualify for a TPVI program included 150 catheterizations/year, association with a surgical program, submission of all cases to a national registry, and, for patients, 80% freedom from re-intervention at 1 year.

*American Heart Association and American College of Cardiology*

In 2014, the American Heart Association (AHA) and the ACC issued guidelines for the management of patients with valvular disease. These guidelines do not make specific recommendations on the treatment of primary pulmonary valve disease (stenosis or regurgitation), but instead refer to the 2008 guidelines for the management of adults with congenital heart disease.

In 2008, the AHA and ACC (in collaboration with other medical societies) issued guidelines for the management of adults with congenital heart disease. For patients with isolated valvular pulmonary stenosis, the guidelines make recommendations on balloon valvulotomy or surgical intervention; however, TPVI is not addressed.

*Medicare National Coverage*

There is no national coverage determination (NCD). In the absence of an NCD, coverage decisions are left to the discretion of local Medicare carriers.

*Regulatory Status*

On January 25, 2010, the Melody® Transcatheter Pulmonary Valve (TPV) and the Ensemble® Transcatheter Valve Delivery System (Medtronic, Minneapolis, MN) were approved by the U.S. Food and Drug Administration (FDA) under the humanitarian device exemption program for use
as an adjunct to surgery in the management of pediatric and adult patients with the following clinical conditions:

- Existence of a full (circumferential) right ventricular outflow tract (RVOT) conduit that is 16 mm or greater in diameter when originally implanted, and

- Dysfunctional RVOT conduits with clinical indication for intervention, and either:
  - Regurgitation: moderate-to-severe regurgitation, or
  - Stenosis: mean RVOT gradient ≥ 35 mm Hg

In 2015, approval of the Melody® device was amended to a premarket approval (PMA) because the FDA determined that the device represented a breakthrough technology. The PMA was based, in part, on 2 prospective clinical studies, the Melody® TPV Long-term Follow-up Post Approval Study (PAS) and the Melody TPV New Enrollment PAS.

FDA product code: NPV.

On February 29, 2016 the Food and Drug Administration (FDA) granted expanded approval of the Sapien XT™ transcatheter heart valve (Edwards Lifesciences Corporation) and the NovaFlex + delivery system to include use in percutaneous pulmonary valve implantation (PPVI) procedures.

The Sapien XT was first approved in 2014 for aortic valve implantation in patients with severe aortic stenosis in whom open surgery would be risky. The expanded approval allows for use of the Sapien XT to replace pulmonary valves in adult and pediatric patients who suffer from either a narrowed pulmonary valve or moderate or greater pulmonary regurgitation caused by congenital heart disease. The current supplement was submitted to expand the indication for the Edwards SAPIEN XT Transcatheter Heart Valve to include pulmonic implantation.

The SAPIEN XT Transcatheter Heart Valve and Accessories received FDA approval through the PMA process on February 29, 2016. According to the PMA approval order, this device is indicated for use in pediatric and adult patients with a dysfunctional, non-compliant Right Ventricular Outflow Tract (RVOT) conduit with a clinical indication for intervention and pulmonary regurgitation ≥ moderate and/or mean RVOT gradient ≥ 35 mmHg.

The FDA SSED states that Edwards Lifesciences performed a clinical study to establish a reasonable assurance of safety and effectiveness of pulmonic implantation with the Edwards SAPIEN THV in patients with dysfunctional RVOT conduits in the United States under Investigational Device Exemption (IDE) (entitled the Congenital Multicenter trial of Pulmonic Valve regurgitation Studying the SAPIEN Interventional THV, “COMPASSION” trial). Data from this clinical study were the basis for the PMA approval decision.
References


<table>
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<th>Date</th>
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<td>01/10/12</td>
<td>New Policy – Policy created with literature search through June 15, 2011; considered medically necessary for patients who are high risk for open surgery and are poor surgical candidates due to multiple prior thoracotomies for open heart surgery. Considered investigational for all other indications. Clinical vetting information added.</td>
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<td>09/27/12</td>
<td>Update Coding Section – ICD-10 codes are now effective 10/01/2014.</td>
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<td>01/29/13</td>
<td>Replace policy. Policy updated with literature review, references 4, 5, 13-15, 17 added. Medically necessary statement amended to include “when performed according to FDA-approved indications”.</td>
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<td>01/21/14</td>
<td>Replace policy. Policy updated with literature review, references 4, 5, 13-15, 17 added. Medically necessary statement amended to include “when performed according to FDA-approved indications”.</td>
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<td>Comments</td>
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<td>---------------------------------------------------------------------------------------------------</td>
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<td></td>
<td>FDA-approved indications”. Policy updated with literature review through September 30, 2013. References 13, 14, 16, 18, 21 added. No change to policy statement. Remove ICD-9 procedure and diagnosis codes; remove all ICD-10 codes except 02RH4JZ (which specifically applies) – these will not be used for adjudication.</td>
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<td>09/23/14</td>
<td>Update Related Policies. Add 2.02.30.</td>
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<td>01/19/16</td>
<td>Coding update. New CPT code 33477, effective 1/1/16, added to policy.</td>
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<tr>
<td>02/01/16</td>
<td>Coding update. Added 93799.</td>
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<tr>
<td>09/01/16</td>
<td>Annual Review, approved August 9, 2016. Policy updated with literature review through April 28, 2016; references 3, 5, 7-8, 16, 19, and 36-37 added. Policy statement unchanged. CPT coding updated.</td>
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**Disclaimer:** This medical policy is a guide in evaluating the medical necessity of a particular service or treatment. The Company adopts policies after careful review of published peer-reviewed scientific literature, national guidelines and local standards of practice. Since medical technology is constantly changing, the Company reserves the right to review and update policies as appropriate. Member contracts differ in their benefits. Always consult the member benefit booklet or contact a member service representative to determine coverage for a specific medical service or supply. CPT codes, descriptions and materials are copyrighted by the American Medical Association (AMA). ©2017 Premera All Rights Reserved.

**Scope:** Medical policies are systematically developed guidelines that serve as a resource for Company staff when determining coverage for specific medical procedures, drugs or devices. Coverage for medical services is subject to the limits and conditions of the member benefit plan. Members and their providers should consult the member benefit booklet or contact a customer service representative to determine whether there are any benefit limitations applicable to this service or supply. This medical policy does not apply to Medicare Advantage.
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U.S. Department of Health and Human Services
200 Independence Avenue SW, Room 509F, HHH Building
Washington, D.C. 20201, 1-800-368-1019, 800-537-7697 (TDD)

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Kreyòl ayisyen (Creole):

Avis sila a gen Enfòmasyon Enpòtan ladann. Avis sila a kapab genyen enfòmasyon enpòtan konpansyon apan aksyon w lan oswa konpansyon kouvèti asirans lan atrave Premera Blue Cross. Kapab genyen dat ki enpòtan nan a vis sila a. Ou ka gen pou prin dwa ak aksyon avan seten dat limit pou ka renbe kouvèti asirans sante w la oswa pov yo ka ede w ak depans yo. Se dwa w pou resewva enfòmasyon sa a ak asistans nan lang ou pale a, san ou pa gen pou peye pou sa. Rate nan 800-722-1471 (TTY: 800-842-5357).

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Hmoob (Hmong):


Illokoy (Ilocano):

Daytoy a Pakdaak ket naglaon iti Napateg nga Impormasion. Daytoy a pakdaak mabalini nga adda ket naglaon iti napateg nga impormasion maitagpere iti aksayyonno wenyong coverage babaen iti Premera Blue Cross. Daytoy ket mabalini dagiti importante a petaa iti daytoy a pakdaak. Mabalini nga adda rumgeng nga aramidenyo nga addang sakkab dagiti partikular a naaltingd nga aildaw tapno magpalatinaedyo ti coverage ti salay-ayo wenyong tulong kadagiti gastos. Adda karbenganyo a mangala iti daytoy nga impormasion ken tulong iti bukodyo a pagasasao nga awan ti bayadanyo. Tumawag ti numero nga 800-722-1471 (TTY: 800-842-5357).

Italiano (Italian):
