

MSAC Application 1812

**Transcatheter Edge-To-Edge Repair
(TEER) for the treatment of severe
tricuspid regurgitation (TR) using the
TriClip device**

PICO Set

Context

This Application is seeking listing of transcatheter edge-to-edge repair (TEER) using the TriClip device, for the treatment of patients with severe tricuspid regurgitation (TR), that are symptomatic despite treatment with optimal medical therapy (OMT), with a left ventricular ejection fraction (LVEF) of 20% or more and systolic pulmonary arterial pressure (sPAP) of less than 70 mmHg. Additionally, the patient must be deemed suitable for TEER by a qualified multidisciplinary heart team (MDHT) to ensure appropriate patient selection, reflecting those not suitable for surgery. The patient population is in line with the population for which evidence exists, TRILUMINATE Pivotal.

Owing to relatively high risk of surgical mortality, the mainstay management of patients with severe, symptomatic TR consists of OMT. However, continued management of OMT does not treat the underlying pathology of TR, rather attempts to manage symptoms. In contrast, the mechanism of action of the TEER procedure includes reconstruction of the insufficient tricuspid valve through tissue approximation, thereby minimising regurgitation into the right atrium. Based on the pivotal study, TRILUMINATE Pivotal, TEER is associated with superior efficacy outcomes including but not limited to improved TR severity, reduced heart failure hospitalisations, and quality of life. Studies have shown that worsening in TR severity is associated with increased mortality (Topilsky 2014; Offen 2022). Thus, by improving TR severity, it is expected that TEER will improve survival of the proposed patients relative to continued management of OMT.

Population

Tricuspid valve regurgitation

Tricuspid valve regurgitation is when the tricuspid valve doesn't close properly leading to backflow of the blood into the right atrium. Approximately 29.1% of adults investigated for heart disease in Australia had TR, with 1.8% presenting with severe TR, according to a study done using the National Echocardiography Database of Australia (Offen 2022).

The aetiology of TR can be classified into primary and secondary. Primary TR is related to intrinsic abnormalities in the overall tricuspid valve apparatus, such as infective endocarditis or rheumatic valve disease. Secondary TR refers to valve pathology that is a consequence of some other pathology, such as right ventricular dysfunction or annular dilation (Table 1; Otto 2021). The majority of TR in adults is due to secondary causes (> 90%; Matli 2022).

Table 1 **Classification of TR**

Primary	Secondary
Rheumatic infective endocarditis	Pulmonary hypertension with RV remodelling (primary or secondary to left-sided heart disease)
Iatrogenic (device leads, endomyocardial biopsy)	Dilated cardiomyopathy
Congenital (eg, Ebstein's, levo-transposition of the great arteries)	Annular dilation (associated with AF)*
Other (eg, trauma, carcinoid, drugs, irradiation)	RV volume overload (shunts/high output)

Abbreviations: AF, atrial fibrillation; LVEF, left ventricular ejection fraction; RV, right ventricular; TR, tricuspid valve regurgitation.

*Isolated TR is associated with AF and has LVEF >60%, pulmonary artery systolic pressure <50 mmHg, and no left-sided valve disease, with normal appearing tricuspid valve leaflets.

Source: Otto (2021) Table 19, pg. e131

Isolated TR is a morphologic subtype of TR which is increasingly recognised as a separate entity. As per the American College of Cardiology / American Heart Association (ACC/AHA) 2020 guidelines, isolated TR is characterised by dilation of the right ventricle base and tricuspid annulus, associated with atrial fibrillation (AF), with left ventricular ejection fraction (LVEF) > 60%, pulmonary artery systolic pressure < 50 mmHg, no left-sided valve disease and with normal appearing tricuspid valve leaflets (Otto 2021). In the absence of concomitant pulmonary hypertension or co-existing left-sided heart disease, isolated TR is mainly present in elderly patients with a high prevalence of AF causing right atrial (RA) dilation, tricuspid valve annulus dilation, and tricuspid valve leaflets malcoaptation (Prihadi 2019; Mutlak 2007; Topilsky 2012; Park 2015). In isolated TR, prognosis is strongly dependent on TR severity (10-year survival of 38% vs. 70% in patients with severe and non-severe TR, respectively) (Topilsky 2014).

The stages of TR are provided in Table 2. Both asymptomatic and symptomatic patients with severe TR (Stages C and D, respectively) present with elevated venous pressure, but symptomatic patients also have symptoms of fatigue, dyspnoea, abdominal bloating, and oedema. Stage D TR may also lead to adverse events such as end-organ damage, particularly hepatic or renal failure. TR severity can shift according to changes in preload and pulmonary pressure (Otto 2021).

Table 2 **Stages of TR**

Stage	Definition	Valve haemodynamics	Haemodynamic consequences	Clinical symptoms and presentation
B	Progressive TR	Central jet <50% RA Vena contracta width <0.7cm ERO <0.40cm ² Regurgitant volume <45mL	None	None
C	Asymptomatic severe TR	Central jet ≥50% RA Vena contracta width ≥0.7cm ERO ≥0.40cm ² Regurgitant volume ≥45mL Dense continuous wave signal with triangular shape Hepatic vein systolic flow reversal	Dilated RV and RA Elevated RA with “c-V” wave	Elevated venous pressure No symptoms
D	Symptomatic severe TR	Central jet ≥50% RA Vena contracta width ≥0.7cm ERO ≥0.40cm ² Regurgitant volume ≥45mL Dense continuous wave signal with triangular shape Hepatic vein systolic flow reversal	Dilated RV and RA Elevated RA with “c-V” wave	Elevated venous pressure Dyspnoea on exertion, fatigue, ascites, oedema

Abbreviations: c-V wave, systolic positive wave; ERO, effective regurgitant orifice; RA, right atrial; RV, right ventricular; TR, tricuspid valve regurgitation

Source: Otto (2021) pg. e132

TR is traditionally graded by severity, from mild to severe based on the American Society of Echocardiography (ASE) guidelines (2017) (see Table 3). However, an updated grading system has been proposed by Hahn (2017) which follows the 2017 ASE guidelines for mild/moderate/severe cut-offs (Zoghbi 2017), and further stratifies severe into three categories (severe, massive, and torrential) to encompass TR severity more accurately (Hahn 2017), see Table 3.

Based on the National Echocardiography Database of Australia, 21.4% of adults investigated for heart disease presented with mild TR, 5.9% presented with moderate TR, and 1.8% presented with severe TR (Offen 2022). A relationship exists whereby increasing grades of TR are independently associated with increasing risk of cardiovascular and all-cause mortality (Topilsky 2014; Offen 2022; Chorin 2020). One-year mortality in patients with severe (or worse) TR is reported to be between 41.7-51.6%, while long-term mortality rates are even higher (Offen 2022; Chorin 2020). Additionally, increasing grades of TR are associated with increased heart-failure hospitalisations and reduced quality of life (Chorin 2020; Fujisawa 2022).

Table 3 TR grades of severity

Variable/Grade	Mild	Moderate	Severe (Severe 3)	Massive (Severe 4)	Torrential (Severe 5)
Vena contracta (biplane, mm)	<3	3-6.9	7-13	14-20	≥21
EROA (mm ²)	<20	20-39	40-59	60-79	≥80
3D VCA or quantitative EROA (mm ²)	–	–	75-94	95-114	≥115

Abbreviations: EROA, effective regurgitant orifice area; VCA, vena contracta area

Source: Hahn (2017) Table 1 pg. 1342

Management

There are currently no Australian guidelines regarding the management of TR, however the AHA guidelines for the management of patients with valvular disease (Otto 2021) and the European Society of Cardiology (ESC) guidelines for the management of valvular heart disease (Vahanian 2022) exist. Recommendations for TR from AHA and ESC guidelines are provided according to severity and presentation of the disease, see Table 4. The AHA guidelines state surgery can be beneficial in patients with severe TR, including those with severe isolated TR attributable to annular dilation, in the absence of pulmonary hypertension/left-sided disease (Otto 2021). Similarly, the ESC guidelines recommend surgery be considered in patients with severe, secondary TR who are symptomatic or have RV dilation in the absence of severe RV/LV dysfunction and severe pulmonary vascular disease/hypertension (e.g., isolated TR) (Vahanian 2022).

However, only a small proportion of patients with TR are offered surgical intervention due to high operative risk related to multiple comorbidities and late disease presentation or referral for intervention (Latib 2018). Tricuspid valve surgery, also known as surgical tricuspid valve replacement, is associated with high mortality risk of approximately 12% in patients with TR (Scotti 2022); with mortality rates rising in patients with additional risk factors and comorbidities (Fender 2018).

For those patients with severe, symptomatic secondary TR who are deemed inoperable or at high risk of surgery, evaluation of transcatheter therapy, including TEER, is recommended (Vahanian 2022). As per the AHA/ACC 2020 guidelines diuretics may be used in patients with signs/symptoms of right-sided HF attributable to severe TR (Stages C and D) (Vahanian 2022). Additionally, therapies to treat the primary cause of HF (e.g., pulmonary vasodilators to reduce elevated pulmonary artery pressures, guideline directed management and therapy [GDMT] for heart failure with reduced LVEF, or rhythm control of AF) can be useful in these patients.

In Australia, transcatheter therapy, including TEER (proposed intervention) and transcatheter tricuspid valve (TTV) replacement, is not reimbursed for patients via the MBS. To this end, the

mainstay management of patients with severe TR at high estimated risk for mortality or morbidity with tricuspid valve surgery consists of OMT.

Table 4 Summarised recommendations for management of functional TR relevant to the proposed population

AHA 2020 (Otto 2021)		
COR	LOE	Recommendation
<i>Recommendations for medical therapy of TR</i>		
2a	C-EO	Diuretics may be used in patients with signs/symptoms of right-sided HF attributable to severe TR (Stages C and D).
2a	C-EO	In patients with signs and symptoms of right-sided HF attributable to severe secondary TR (Stages C and D), therapies to treat the primary cause of HF (e.g., pulmonary vasodilators to reduce elevated pulmonary artery pressures, GDMT for HF with reduced LVEF, or rhythm control of AF) can be useful
<i>Recommendations for timing of intervention</i>		
1	B-NR	In patients with severe TR (Stages C and D) undergoing left-sided valve surgery, tricuspid valve surgery is recommended.
2a	B-NR	In patients with progressive TR (Stage B) undergoing left-sided valve surgery, tricuspid valve surgery can be beneficial in the context of either 1) tricuspid annular dilation (tricuspid annulus end diastolic diameter >4.0 cm) or 2) prior signs and symptoms of right-sided HF.
2a	B-NR	In patients with signs and symptoms of right-sided HF and severe primary TR (Stage D), isolated tricuspid valve surgery can be beneficial to reduce symptoms and recurrent hospitalizations.
2a	B-NR	In patients with signs and symptoms of right sided HF and severe isolated secondary TR attributable to annular dilation (in the absence of pulmonary hypertension or left-sided disease) who are poorly responsive to medical therapy (Stage D), isolated tricuspid valve surgery can be beneficial to reduce symptoms and recurrent hospitalizations
2b	C-LD	In asymptomatic patients with severe primary TR (Stage C) and progressive RV dilation or systolic dysfunction, isolated tricuspid valve surgery may be considered.
2b	B-NR	In patients with signs and symptoms of right sided HF and severe TR (Stage D) who have undergone previous left-sided valve surgery, reoperation with isolated tricuspid valve surgery may be considered in the absence of severe pulmonary hypertension or severe RV systolic dysfunction
ESC 2021 (Vahanian 2022)		
COR	LOE	Recommendation
<i>Recommendations on secondary TR</i>		
I	B	Surgery is recommended in patients with severe secondary TR undergoing left-sided valve surgery
IIa	B	Surgery should be considered in patients with mild/moderate secondary TR with a dilated annulus ($\geq 40\text{mm}$ or $>21\text{mm/m}^2$ by 2D echocardiography) undergoing left-sided valve surgery.
IIa	B	Surgery should be considered in patients with severe secondary TR with or without previous left-sided surgery) who are symptomatic or have RV dilation, in the absence of severe RV/LV dysfunction and severe pulmonary vascular disease/hypertension.
IIb	C	Transcatheter treatment of symptomatic secondary severe TR may be considered in inoperable patients at a Heart Valve Centre with expertise in the treatment of tricuspid valve disease.

Abbreviations: AF, atrial fibrillation; COR, Class of Recommendation; HF, heart failure; GDMT, guideline directed management and therapy; LOE, Level of Evidence; TR, tricuspid valve regurgitation; RV, right ventricular

AHA Guidelines classes of recommendation and levels of evidence:

Class 2a: moderate. Suggested phrases for writing recommendations: is reasonable; can be useful/effective/beneficial; comparative-effectiveness phrases: treatment/strategy A is probably recommended/indicated in preference to treatment B, it is reasonable to choose treatment A over treatment B

Class 2b: weak. Suggested phrases for writing recommendations: may/might be reasonable; may/might be considered; usefulness/effectiveness is unknown/unclear/uncertain or not well established

Level of Evidence C-EO: expert opinion. Consensus of expert opinion based on clinical experience

Level of Evidence B-NR: nonrandomised. Moderate-quality evidence from one or more well-designed, well-executed nonrandomised studies, observational studies, or registry studies; meta-analyses of such studies

ESC guidelines class of recommendations and levels of evidence:

Class I: conditions for which there is evidence and/or general agreement that a given procedure or treatment is beneficial, useful, and effective

Ia: conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.

Weight of evidence/opinion is in favour of usefulness/efficacy

Iib: conditions for which there is conflicting evidence and/or divergence of opinion about the usefulness/efficacy of a procedure or treatment; usefulness/efficacy is less well established by evidence/opinion

Level of Evidence B: data derived from one or more randomised/nonrandomised trials or meta-analysis of such studies

Level of Evidence C: nonrandomised observational studies with limitations in design or execution or meta-analysis of such studies; consensus opinions of experts based on clinical experience

Source: Otto (2021) Section 8 Table 8.2.2 pg. e132; Otto (2021) Section 8 Table 8.2.3 pg. e133; Vahanian (2022) Section 10 Table pg. 599

A number of surgical risk assessment tools are available, to establish mortality and morbidity risk of TV surgery. These include the EuroSCORE, the Society of Thoracic Surgeons (STS) Risk Score, and the TRI-SCORE scoring system (Gröger 2023). In the Ratified PICO for Application 1799, PASC expressed “concerns around the reliability of surgical risk prediction tools in this patient cohort” (p. 15).

Specify any characteristics of patients with the medical condition, or suspected of, who are proposed to be eligible for the proposed health technology, describing how a patient would be investigated, managed and referred within the Australian health care system in the lead up to being considered eligible for the technology:

Proposed population

The proposed population for whom listing of TEER is sought on the Medicare Benefits Schedule includes patients with severe TR who are symptomatic (NYHA Functional Class II, III or ambulatory class IV) despite treatment with OMT, with sPAP <70mmHg, LVEF >20%, and are deemed by a qualified multidisciplinary heart team to be suitable for TEER.

The proposed population is informed by the pivotal study, TRILUMINATE Pivotal (Sorajja 2023). An overview of the eligibility criteria of TRILUMINATE Pivotal is provided in Table 5. Patients were eligible if they presented with severe TR, were symptomatic (NYHA class II, III, or IVa), with a pulmonary artery systolic pressure of < 70 mmHg and were receiving stable (\geq 30 days) OMT, without other cardiovascular conditions warranting interventional or surgical correction, and were at intermediate or greater surgical risk as determined by the local heart team (Sorajja 2023).

Table 5 Eligibility criteria of TRILUMINATE Pivotal trial

Inclusion criteria	Exclusion criteria
<p>In the judgement of the site local heart team, subject has been adequately treated per applicable standards (including medical managements) and stable for at least 30 days as follows:</p> <p>Optimised medical therapy for treatment of TR (e.g., diuretics)</p> <p>Medical and/or device therapy, for MR, AF, CAD, and HF</p> <p>The ECL will confirm that the subject has been adequately treated medically</p>	sPAP >70mmHg or fixed pre-capillary pulmonary hypertension as assessed by RHC.
	Severe uncontrolled hypertension SBP ≥180mmHg and/or DBP ≥110mmHg
	Any prior tricuspid valve procedure that would interfere with placement of the TriClip™ device
	Indication for left-sided (e.g., severe aortic stenosis, severe MR) or pulmonary valve correction prior 60 days. Note: Patients with concomitant mitral and tricuspid valve disease will have the option of getting their MR treated, and wait 60 days prior to being reassessed for the trial.
Subject is symptomatic with severe TR despite being optimally treated. TR severity is determined by the assessment of a qualifying TTE and confirmed by the ECL. The ECL will also request a TEE to confirm TR aetiology	Pacemaker or ICD leads that would prevent appropriate placements of the TriClip™ Clip.
The cardiac surgeon of the site local heart team occur that the patient is at intermediate or greater estimated risk for mortality or morbidity with tricuspid valve surgery	Tricuspid valve stenosis – defined as a tricuspid valve orifice of ≤1.0cm ² and/or mean gradient ≥5mmHg as measured by the ECL
NYHA Functional Class II, III or ambulatory class IV	LVEF≤20%
In the judgement of the TriClip™ implanting Investigator, femoral vein access is determined to be feasible and can accommodate a 25 French catheter	<p>Tricuspid valve leaflet anatomy which may preclude clip implantation, proper clip positioning on the leaflets or sufficient reduction in TR. This may include:</p> <p>Evidence of calcification in the grasping area</p> <p>Presence of a severe coaptation defect (>2cm) of the tricuspid leaflets</p> <p>Severe leaflet defect(s) preventing proper device placement</p> <p>Ebstein Anomaly – identified by having a normal annulus position while the valve leaflets are attached to the walls and septum of the RV.</p>
Age ≥18 years at time of consent	Tricuspid valve anatomy not evaluable by the TTE and TEE

Abbreviations: AF, atrial fibrillation; CAD, coronary artery disease; DBP, Diastolic Blood Pressure; EC, executive committee; ECL, Echocardiography Core Lab; GI, gastrointestinal; HF, heart disease; ICD, implantable cardioverter-defibrillator; IVC, inferior vena cava; LVEF, Left Ventricular Ejection Fraction; MI, myocardial infarction; MR, mitral valve regurgitation; NYHA, New York Heart Association; RHC, right heart catheterisation; RV, right ventricle; SBP, Systolic Blood Pressure; sPAP, systolic pulmonary arterial pressure; TEE, transesophageal echocardiogram; TR, tricuspid regurgitation; TTE, transthoracic echocardiogram

Source: Sorajja (2023), Supplementary Appendix Table S2 pg. 25-26

The baseline characteristics of the trial population is provided in Table 6. Most patients in the trial had functional TR (TriClip vs OMT: 94.8% vs 92.9%), experienced AF (87.5% vs 92.6%), had LVEF around 60% (levels 59.3% vs 58.7%) and sPAP of around 40 mmHg (39.7 mmHg vs 40.1 mmHg).

Table 6 Baseline characteristics: TRILUMINATE Pivotal

Characteristics of the Patients at Baseline	TriClip™	OMT
Age (years), mean ± SD	78.0±7.4	77.8±7.2
Female sex, n (%)	98 (56.0)	94 (53.7)
New York Heart Association Class III or IV, n (%)	104 (59.4)	97 (55.4)

Characteristics of the Patients at Baseline	TriClip™	OMT
Atrial fibrillation, n (%)	153 (87.4)	162 (92.6)
Atrial flutter, n/total (%)	20/174 (11.4)	22/174 (12.6)
Dyslipidemia, n (%)	117 (66.9)	92 (52.6)
Hypertension, n (%)	142 (81.1)	141 (80.6)
Stroke, n (%)	11 (6.3)	19 (10.9)
Transient ischemic attack, n (%)	13 (7.4)	17 (9.7)
Diabetes mellitus, n (%)	28 (16.0)	27 (15.4)
Peripheral vascular disease, n (%)	16 (9.1)	18 (10.3)
Coronary artery bypass grafting, n (%)	31 (17.7)	36 (20.6)
Percutaneous coronary intervention, n (%)	26 (14.9)	23 (13.1)
Kidney disease, n (%)	62 (35.4)	62 (35.4)
Liver disease, n (%)	11 (6.3)	16 (9.1)
Chronic obstructive pulmonary disease, n (%)	19 (10.9)	24 (13.7)
CRT, CRT-D, ICD, or permanent pacemaker, n (%)	28 (16.0)	24 (13.7)
Previous cardiac or transcatheter therapy, n (%)		
Aortic-valve intervention	27 (15.4)	27 (15.4)
Surgical mitral valve repair	14 (8.0)	9 (5.1)
Percutaneous mitral valve repair	18 (10.3)	22 (12.6)
Mitral valve repair	10 (5.7)	9 (5.1)
Tricuspid valve repair	1 (0.6)	0
Hospitalisation for heart failure within 1 year before enrolment, n (%)	44 (25.1)	44 (25.1)
KCCQ score, mean ± SD	56.0±23.4	54.1±24.2
B-type natriuretic peptide level – pg/mL, mean ± SD	382.0±347.5	355.4±283.4
Body-mass index, mean ± SD	27.0±5.8	26.9±5.2
6-minute walk distance – m, mean ± SD	240.5±117.1	253.6±129.1
Glomerular filtration rate, mL/min/1.73m ² , mean ± SD	54.1±20.4	56.9±20.0
Medications, n (%)		
β-receptor antagonist	114 (65.1)	115 (65.7)
ACE-I, ARB, or ARNI	68 (38.9)	66 (37.7)
Vasodilator	14 (8.0)	17 (9.7)
Diuretic	152 (86.9)	161 (92.0)
Left ventricular ejection fraction - %, mean ± SD	59.3±9.3	58.7±10.5
Left ventricular ejection fraction <50%, n (%)	23 (14)	21 (14)
Left ventricular end diastolic volume – mL, mean ± SD	81.5±33.2	84.5±37.2
Left ventricular end systolic volume – mL, mean ± SD	34.1±18.4	36.8±26.0
Functional aetiology of TR, n (%)	165 (94.8)	158 (92.9)
Severity of TR, n (%)		
Moderate	4 (2.3)	2 (1.2)

Characteristics of the Patients at Baseline	TriClip™	OMT
Severe	44 (25.4)	49 (29.7)
Massive	37 (21.4)	30 (18.2)
Torrential	88 (50.9)	84 (50.9)
Coaptation gap – mm, mean ± SD	5.5±1.8	5.2±1.7
Tricuspid annular plane systolic excursion ≥1.7cm, n (%)	83 (48.0)	68 (41.2)
Right ventricular fractional area change - %, mean ± SD	36.6±5.5	37.2±6.3
Right ventricular end diastolic diameter – cm, mean ± SD	5.0±0.8	5.2±0.8
Right atrial volume – mL, mean ± SD	143.2±85.4	153.2±83.2
Tricuspid annular diameter – cm, mean ± SD	4.3±0.7	4.5±0.8
Cardiac output – L/min, mean ± SD	4.1±1.2	4.2±1.1
Central venous pressure – mmHg, mean ± SD	11.7±5.2	12.0±6.0
Pulmonary artery systolic pressure – mmHg, mean ± SD	39.7±9.2	40.1±10.1
Mean pulmonary artery pressure – mmHg, mean ± SD	25.5±5.7	25.6±6.4
Pulmonary capillary wedge pressure – mmHg, mean ± SD	14.8±4.6	15.1±4.3
Systolic blood pressure – mmHg, mean ± SD	121.4±13.1	122.1±12.8
Pulmonary vascular resistance – Wood units, mean ± SD	2.5±1.1	2.4±1.1

Abbreviations: ACE-I, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blockers; ARNI, angiotensin receptor/neprilysin inhibitor; CRT, Cardiac Resynchronisation Therapy; CRT-D, Cardiac Resynchronisation Therapy defibrillator; ICD, implantable cardioverter-defibrillators; KCCQ, Kansas City Cardiomyopathy Questionnaire; n, number; SD, standard deviation; TR, tricuspid valve regurgitation
Source: Sorajja (2023), Table 1 pg. 5; Sorajja (2023), Supplementary Appendix Table S4 pg. 28

How a patient is investigated leading up to the proposed procedure

TR is commonly identified in asymptomatic patients during routine echocardiography owing to other causes. Meanwhile, symptomatic patients may present with fatigue, dyspnoea on exertion, peripheral oedema, ascites, gastrointestinal symptoms, and right heart failure; with renal and hepatic failure also presenting in patients with advanced disease (Otto 2021).

An evaluation pathway for these patients in Australia has been reviewed and accepted by PASC in MSAC Application 1799 for '*Transcatheter tricuspid valve replacement in patients with severe, symptomatic tricuspid regurgitation despite optimal medical therapy*'. Patients eligible for TEER will undergo similar tests and procedures to be diagnosed with TR; thus, this pathway remains applicable to this current Application.

An initial clinical evaluation assessment will be undertaken by a general practitioner (GP) to review medical history for conditions associated with TR, including heart failure and other comorbidities. The GP will then refer the patient to a cardiologist if the presence of TR is suspected.

A TR diagnosis is confirmed using imaging techniques:

- Transthoracic echocardiography (TTE) is the primary imaging technique used for screening TR, used to evaluate valve structure and TR severity.
- Transoesophageal echocardiography (TOE) provides detailed images and can be used to confirm the diagnosis, particularly when TTE results are inconclusive

Following confirmation of the presence of TR and severity of disease, patients are then evaluated by a multidisciplinary heart team consisting of an interventional cardiologist, cardiac imaging specialist, and potentially a cardiothoracic surgeon, assessing the patient's overall risk, anatomy, and suitability for further intervention. More details of the treatment algorithm are provided later in the Application.

Provide a rationale for the specifics of the eligible population:

The proposed population is consistent with the population from the pivotal TRILUMINATE Pivotal trial and hence for whom evidence exists. A high clinical need for an effective intervention exists in these patients given the mainstay management consists of OMT, which merely manages symptoms and does not address the underlying pathology of TR.

The proposed population for TEER does not limit eligibility to those at intermediate or greater estimated risk for mortality or morbidity with tricuspid valve surgery as stipulated in the TRILUMINATE Pivotal trial; however, suitability will be confirmed via a multidisciplinary case conference to ensure appropriate patient selection. This is also consistent with PASC's deliberation of Application 1799. *"PASC discussed whether surgical ineligibility should be specified in the population, noting that isolated tricuspid valve surgery is a high-risk operation and surgical risk prediction tools are not accurate for assessing that risk. PASC acknowledged that clinical practice guidelines advise that surgery should be offered in patients with severe, symptomatic TR; however, current guidelines do not provide clear advice on patient selection nor the threshold for surgical intervention. PASC noted that surgeons are often reluctant to offer isolated tricuspid valve surgery because of the high mortality risk and uncertain outcomes in this cohort of patients. PASC decided that surgical ineligibility or risk should not be a criterion for the population and any decisions about suitability for surgical or transcatheter intervention should be at the discretion of the multidisciplinary heart team"* (pg. 4).

Are there any prerequisite tests?

Yes

Are the prerequisite tests MBS funded?

Yes

Anatomical suitability for TEER needs to be established, using echocardiographic imaging, prior to patients accessing the proposed service. All required work up tests are currently funded via the MBS, as outlined in

Table 7.

Table 7 Work up tests funding on the MBS

MBS item	Item descriptor	Fee
55126	Initial real time transthoracic echocardiographic examination of the heart with real time colour flow mapping from at least 3 acoustic windows, with recordings on digital media, if the service: (a) is for the investigation of any of the following: (i) symptoms or signs of cardiac failure; (ii) suspected or known ventricular hypertrophy or dysfunction; (iii) pulmonary hypertension; (iv) valvular, aortic, pericardial, thrombotic or embolic disease; (v) heart tumour; (vi) symptoms or signs of congenital heart disease; (vii) other rare indications; and (b) is not associated with a service to which: (i) another item in this Subgroup applies (except items 55137, 55141, 55143, 55145 and 55146); or (ii) an item in Subgroup 2 applies (except items 55118 and 55130); or (iii) an item in Subgroup 3 applies Applicable not more than once in a 24 month period (R)	Fee: \$264.90 Benefit: 75% = \$198.70 85% = \$225.20
22051	Intra-operative transoesophageal echocardiography—monitoring in real time the structure and function of the heart chambers, valves and surrounding structures, including assessment of blood flow, with appropriate permanent recording during procedures on the heart, pericardium or great vessels of the chest, other than a service associated with a service to which item 55130, 55135 or 21936 applies (H)	Fee: \$207.90 Benefit: 75% = \$155.95

Please provide details to fund the prerequisite tests:

Not applicable, as all prerequisite tests are funded on the MBS.

Intervention

Name of the proposed health technology:

Transcatheter edge-to-edge repair (TEER).

TEER will be used with continued OMT.

Describe the key components and clinical steps involved in delivering the proposed health technology:

The proposed intervention involves the use of one of two device systems, TriClip™ (Abbott) or PASCAL (Edwards), registered for use in TR in Australia. To note however, and as shown in the Summary of Evidence Section, to date, no randomised controlled trials (RCTs) of the PASCAL system versus OMT in the proposed population exist. A forthcoming RCT comparing TEER using the PASCAL system with OMT (CLASP II TR; NCT04097145) has an expected primary completion date in December 2027. To this end, the comparative evidence of TEER versus OMT that will be provided in the forthcoming Applicant Developed Assessment Report (ADAR) will pertain to the TriClip device. Details provided in this section of the intervention therefore related to the TriClip system only.

Table 8 TEER systems included in the ARTG

Product Name	PASCAL Precision System	TriClip Transcatheter Tricuspid Valve Repair System
Sponsor	Edwards Lifesciences Pty Ltd	Abbott Medical Australia Pty Ltd
ARTG ID	410289 – PASCAL Precision System – PASCAL ACE Implant System – Heart valve clip 410288 – PASCAL Precision System – Implant System – Heart valve clip 410290 – PASCAL Precision System – Guide Sheath – Heart valve clip	373218 - TriClip Delivery System - Mitral valve clip 373219 - TriClip Steerable Guide Catheter Model Number TSGC0205 - Catheter, intravascular, guiding 401430 - TriClip G4 Delivery System - Mitral valve clip 401431 - TriClip G4 Steerable Guide Catheter - Catheter, intravascular, guiding 444061 – TriClip G4 Clip Delivery System – Mitral valve clip 444062 – TriClip Steerable Guide Catheter – Catheter, intravascular, guiding 498645 - TriClip G5 Delivery System - Heart valve clip 498646 - TriClip G5 Steerable Guide Catheter - Catheter, intravascular, guiding
GMDN	57790 Heart valve clip	57790 Heart valve clip 17846 Catheter, intravascular, guiding
Category	Medical Device Class III	Medical Device Class III
Effective Date	9 June 2023	20 March 2024

Product Name	PASCAL Precision System	TriClip Transcatheter Tricuspid Valve Repair System
Intended purpose	The PASCAL Precision system is intended to repair an insufficient mitral and/or tricuspid valve via percutaneous reconstruction through tissue approximation. The PASCAL Precision system percutaneously delivers the implant to the valve via a femoral vein access using a transvenous, transseptal (mitral) and transvenous (tricuspid) approach.	The TriClip™ G4 System is intended for reconstruction of the insufficient tricuspid valve through tissue approximation. The TriClip device is indicated for patients with severe tricuspid regurgitation who are symptomatic despite medical therapy with valve anatomies that are conducive for transcatheter repair and who have been determined to be at high or greater estimated risk for tricuspid valve surgery by a Heart Team.
Specific Conditions	No specific conditions	Final study reports of the 'TRILUMINATE Pivotal Study' and 'bRIGHT EU Post Approval Study' with a 5-year follow-up must be provided by 31st July 2028. The final study reports must be accompanied by the manufacturer's analysis of the data, with redlined changes made to the clinical evaluation report (CER) and risk management documents based on the final study results.

Abbreviations: ARTG, Australian Register of Therapeutic Goods; GMDN, Global Medical Device Nomenclature
Source: Table 4 of Application 1799 Ratified PICO.

The TriClip G4 system consists of two parts: the TriClip G4 Delivery System, and the TriClip Steerable Guide Catheter. The delivery system itself consists of three major components (the Delivery Catheter, the Steerable Sleeve, and the TriClip G4 implant) while the Steerable Guide Catheter includes a dilator.

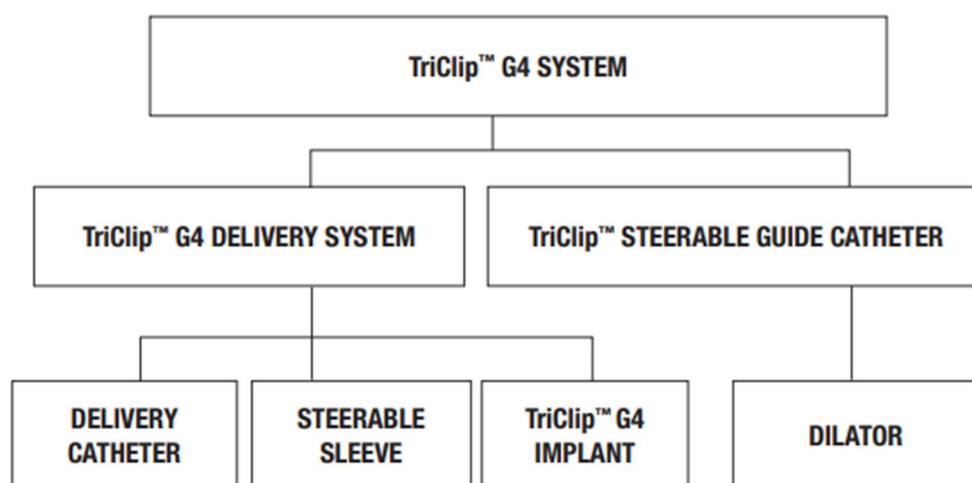


Figure 1 TriClip G4 System components

Source: TriClip G4 System Instructions for Use (EL2143121 Rev. A) pg. 3

The TriClip G4 Delivery System is introduced into the body through the TriClip Steerable Guide Catheter. The TriClip G4 Delivery System advanced and manipulates the TriClip G4 Implant for proper positioning and placement on the tricuspid valve leaflets. The outer surfaces of the Delivery Catheter and the TriClip Steerable Guide Catheter have a hydrophilic coating, intended to decrease friction during insertion into the vasculature (Steerable Guide Catheter) and decrease friction between the Steerable Sleeve and the Delivery Catheter.

The TriClip G4 Implant is a percutaneously implanted mechanical implant that comes in four sizes (G4 NT, G4 XT, G4 NTW, G4 XTW). The dimensions of these implant sizes are presented in Table 9.

Table 9 TriClip G4 Implant Dimensions

TriClip G4 Implant	G4 NT	G4 NTW	G4 XT	G4 XTW
Grasping Width at 120 degrees	17 mm minimum		22 mm minimum	
Implant Width at 180 degrees	20 mm nominal		25 mm nominal	
Arm Width	4 mm maximum	6 mm maximum	4 mm maximum	6 mm maximum
Arm Length (Coaptation length)	9 mm maximum		12 mm maximum	

Source: TriClip G4 System Instructions for Use (EL2143121 Rev. A) pg. 2

The TriClip G4 Implant grasps and coapts the tricuspid valve leaflets resulting in fixed approximation of the tricuspid leaflets through the cardiac cycle. The TriClip G4 is manufactured with metal alloys and polyester fabric (TriClip G4 Implant cover) that are commonly used in cardiovascular implants. The TriClip G4 Implant Arms can be adjusted to any position from fully opened, fully inverted and fully closed to allow the implant to grasp and approximate the leaflets of the tricuspid valve using controls on the Delivery Catheter Handle. The TriClip G4 Implant can be locked, unlocked and repeatedly opened and closed.

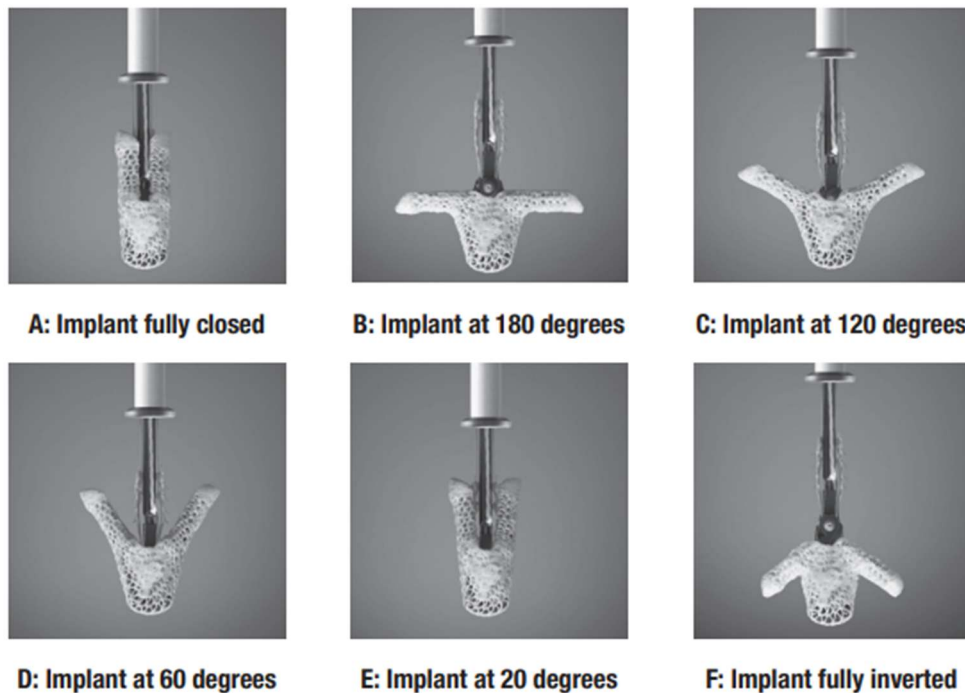


Figure 2 TriClip G4 Implant positions

Source: TriClip G4 System Instructions for Use (EL2143121 Rev. A) Figure 7

The TriClip Steerable Guide Catheter is used to introduce the TriClip G4 Delivery System into the right side of the heart. The TriClip Steerable Guide Catheter is also used to position and orient the TriClip G4 Delivery System to the appropriate location above the tricuspid valve. The Dilator is used for the introduction of the TriClip Steerable Guide Catheter into the femoral vein and right atrium.

Steps

The device is delivered through the femoral vein. The patient is prepared for transfemoral catheterisation per institution's standard practice, and the patient is monitored using invasive haemodynamic monitoring techniques.

All components of the device are sterilised, and all Catheter components are flushed and de-aired prior to the procedure.

Steps to the procedure:

- **Access to the tricuspid valve:** the Guide Catheter is extended through the femoral vein using a guidewire, to the superior vena cava from where it accesses the right atrium. The Dilator is used to dilate the subcutaneous tissue and femoral vein to accommodate the Guide shaft.
- **Steerable Guide Catheter insertion:** the Guide-Dilator assembly is advanced into the right atrium with the guidewire, and a Stabiliser is secured to the Guide. Both the Dilator and guidewire are retracted while gently aspirating the Guide using a 50-60 cc syringe.

- **TriClip G4 Delivery System insertion:** The Delivery system is advanced through the Guide carefully under fluoroscopic guidance until the top of the Implant is even with the tip of the Guide. Under echocardiographic and fluoroscopic guidance, the Delivery System is advanced, and the Guide is iteratively retracted whilst maintaining position in the Right Atrium.
- **Initial TriClip G4 System positioning in right atrium:** The system is positioned centrally over the valve and aligned so the Implant Delivery Catheter shaft is perpendicular to the plane of the tricuspid valve, positioning the distal tip of the Implant above the leaflets. The Implant must be free from adjacent tissue.
- **Final TriClip G4 System positioning:** The Grippers are raised, the Implant arms are unlocked and opened to approximately 180 degrees, and the Implant is positioned so the distal tip of the Implant is above the leaflets and the Implant arms are perpendicular to the line of coaptation. The Implant arms are then closed to approximately 60 degrees.
- **Grasping the leaflets and verifying the grasp:** The Delivery Catheter is advanced distally to position the Implant below the valve, and the Implant Arms are oriented perpendicular to the line of coaptation. The Implant arms are opened to the grasping arm angle of 120 degrees, and the Delivery Catheter is retracted to grasp both leaflets. The Implant is closed to approximately 60 degrees and the Delivery Catheter Fastener is secured. Echocardiographic imaging verifies insertion of both leaflets and satisfactory grasp by observation of leaflet immobilisation, single or multiple valve orifices, limited leaflet mobility relative to the tips of both Implant Arms, and adequate TR reduction.
- **Closing the TriClip G4 Implant and evaluating position:** The Implant is locked and closed until the leaflets are coapted and TR is sufficiently reduced. It is noted that the Implant should maintain a distinct "V" shape. Echocardiographic imaging is used to verify valve function, satisfactory coaptation, and insertion of both leaflets as above.
- **Implant assessment:** The Implant angles are assessed and finalised.
- **TriClip G4 Implant Deployment:** The Lock Line is removed, and the final arm angle is established so that Implant arms may open a maximum of 5 degrees after which it remains in a stable position. The Delivery Catheter Shaft is detached ensuring that the Implant position remains stable.
- **TriClip G4 Delivery System removal.**

Identify how the proposed technology achieves the intended patient outcomes:

The TriClip device, used for TEER, works by clipping together the leaflets of the tricuspid valve to reduce or prevent backward blood flow (regurgitation) from the right ventricle to the right atrium. This edge-to-edge repair technique aims to improve the valve's ability to close properly, thus reducing the workload on the heart. By approximating the leaflets, the clip reduces the amount of blood that leaks backward during ventricular contraction, hence improves TR severity, which in turn has positive implications on mortality and quality of life of the patient.

Does the proposed health technology include a registered trademark component with characteristics that distinguishes it from other similar health components?

Yes

Explain whether it is essential to have this trademark component or whether there would be other components that would be suitable:

Given the available comparative evidence of TEER versus OMT is limited to the TriClip™ system, and to date no RCT evidence exists for the PASCAL system, it may be necessary to specify the TriClip™ device in the MBS item descriptor, similar to the MitraClip™ device being included in the item descriptor for the TMVr procedure for functional mitral regurgitation (MBS item 38463).

Are there any proposed limitations on the provision of the proposed health technology delivered to the patient (For example: accessibility, dosage, quantity, duration or frequency): (please highlight your response)

Yes

Provide details and explain:

The TEER procedure is performed exclusively at specialised cardiac centres by accredited heart specialists with expertise in structural heart interventions. Patients must meet defined eligibility criteria stipulated in the proposed MBS item descriptor. To ensure appropriate patient selection, a multidisciplinary heart team must thoroughly assess each patient to determine their suitability for TEER.

If applicable, advise which health professionals will be needed to provide the proposed health technology:

The TEER procedure will be primarily performed by appropriately trained interventional cardiologists or cardiothoracic surgeons.

Cardiac Imaging Specialist (e.g., Echocardiographer): Provides real-time imaging guidance.
Anaesthetist: Provides sedation or general anaesthesia.

If applicable, advise whether delivery of the proposed health technology can be delegated to another health professional:

No

If applicable, advise if there are any limitations on which health professionals might provide a referral for the proposed health technology:

Referral for TEER is typically initiated by the patient's specialist, most often a cardiologist. Eligibility for TEER is determined by a MDHT, which must include at least an interventional cardiologist or cardiothoracic surgeon, and a specialist or consultant physician other than the specialist performing the procedure (e.g., other than interventional cardiologist or surgeon).

Is there specific training or qualifications required to provide or deliver the proposed service, and/or any accreditation requirements to support delivery of the health technology? (please highlight your response)

Yes

Provide details and explain:

Interventional cardiologists must undergo specific training in transcatheter tricuspid valve repair, including proctoring and certification by Abbott. Hospitals must be accredited structural heart centres as per Cardiac Accreditation Criteria for other complex Structural Heart therapies (e.g., TAVI, MitraClip).

Indicate the proposed setting(s) in which the proposed health technology will be delivered: (select all relevant settings)

- Inpatient private hospital
- Inpatient public hospital

The proposed medical service can be provided at a public or private hospital as an inpatient procedure.

Is the proposed health technology intended to be entirely rendered inside Australia?

Yes

Please provide additional details on the proposed health technology to be rendered outside of Australia:

N/A

Comparator

Nominate the appropriate comparator(s) for the proposed medical service (i.e. how is the proposed population currently managed in the absence of the proposed medical service being available in the Australian health care system). This includes identifying health care resources that are needed to be delivered at the same time as the comparator service:

The nominated comparator to TEER in the proposed population is continued OMT alone. The comparator to TEER in the pivotal study (TRILUMINATE Pivotal) is OMT. Whilst surgery is included in guidelines, only selected patients are currently being offered surgical intervention, mainly due to high operative risk owing to a multitude of comorbidities and late presentation or referral for intervention (Latib 2018).

As per the ESC and AHA guidelines diuretics is the mainstay treatment for patients with TR in the presence of right heart failure (Vahanian 2022; Otto 2021).

Other medical therapies are tailored according to patients' comorbidities. That is, patients with signs and symptoms of right sided heart failure due to severe secondary TR, may also receive therapies to treat the primary cause of heart failure (such as pulmonary vasodilators to reduce elevated pulmonary artery pressures, guideline directed management and therapy for heart failure with reduced LVEF, or rhythm control for AF) (Otto 2021). According to the ESC guidelines, the addition of an aldosterone antagonist may be considered to counteract the activation of the renin-angiotensin-aldosterone system associated with hepatic congestion. The ESC guidelines

also note rhythm control may help to reduce TR and contain annular dilatation in patients with chronic AF, although data are limited (Vahanian 2022).

The AHA 2020 guideline recommendations for medical therapy for TR is provided in Table 10.

Table 10 AHA 2020 guideline recommendations for medical therapy for TR

COR	LOE	Recommendation
2a	C-EO	In patients with signs and symptoms of right-sided HF attributable to severe TR (Stages C and D), diuretics can be useful.
2a	C-EO	In patients with signs and symptoms of right-sided HF attributable to severe secondary TR (Stages C and D), therapies to treat the primary cause of HF (eg, pulmonary vasodilators to reduce elevated pulmonary artery pressures, GDMT for HF with reduced LVEF, or rhythm control of AF) can be useful.

Abbreviations: AF, atrial fibrillation; GDMT, guideline directed management and therapy; HF, heart failure; LVEF, left ventricular ejection fraction
Source: Otto (2021) Section 8.2.2

List any existing MBS item numbers that are relevant for the nominated comparators:

None.

Please provide a rationale for why this is a comparator:

OMT is the mainstay treatment of the proposed patients with severe, symptomatic TR given open heart surgery would be an unsafe or unacceptable option for the majority of these patients.

OMT was similarly the comparator to TTV replacement as per the Ratified PICO for Application 1799. Given this application seeking listing on the MBS for TTV replacement is currently going through the MSAC process, TTV replacement could potentially be a near to market comparator to TEER. However, as per the Ratified PICO, *"PASC agreed that TTV repair is not an appropriate comparator because it was unlikely to be replaced in clinical practice, having only recently been adopted in Australia. Additionally, PASC noted advice from the applicant's clinical experts that the anatomy and pathology of patients who would undergo TTV repair differ from those who would receive TTVR"* (1799 PICO). To this end, TTV replacement is not nominated as a near to market comparator.

Pattern of substitution – Will the proposed health technology wholly replace the proposed comparator, partially replace the proposed comparator, displace the proposed comparator or be used in combination with the proposed comparator?

None – used with the comparator

Please outline and explain the extent to which the current comparator is expected to be substituted:

The proposed intervention, TEER, will be used alongside the comparator OMT. Some patients may be able to reduce the dose or intensity of the OMT regimen after TEER.

Outcomes

List the key health outcomes (major and minor – prioritising major key health outcomes first) that will need to be measured in assessing the clinical claim for the proposed medical service/technology (versus the comparator):

- Health benefits
- Health harms
- Resources

Type	Outcome
Health benefit	Hierarchical composite primary outcome that included: <ul style="list-style-type: none"> • death from any cause or tricuspid valve-surgery; • hospitalisation for heart failure; and • an improvement in quality of life defined as a ≥ 15 point increase in the KCCQ. Assessed at 1 year
	Mortality (all cause, cardiovascular)
	Change in TR severity (severe, massive or torrential)
	Quality of life assessed via change in KCCQ score and other measures
	Heart failure hospitalisation
	Health status (NYHA functional class and 6-minute walk distance)
	Change in medical therapy (dose, frequency, type)
Health harm	Freedom from major adverse events within 30 days (TEER group only). Defined as: <ul style="list-style-type: none"> • death from cardiovascular causes, • new-onset kidney failure, • endocarditis treated with surgery, and nonelective cardiovascular surgery for a TriClip device–related adverse event
	Procedural complications
	Tricuspid valve reinterventions
	Serious and non-serious adverse event
Health care resources	<ul style="list-style-type: none"> • Cost of TEER prosthesis and other consumables • Cost to deliver TEER intervention • Cost associated with changes in clinical management (testing required before the procedure, length of hospital stay, post-discharge rehabilitation) • Cost associated with management of complications (including reintervention)

Abbreviation: 6MWD, 6 minute walk distance; KCCQ, Kansas City Cardiomyopathy Questionnaire; OMT, optimised medical therapy; TEER, tricuspid transcatheter edge-to-edge repair; TR, tricuspid regurgitation

Outcome description – please include information about whether a change in patient management, or prognosis, occurs as a result of the test information:

N/A

Proposed MBS items

How is the technology/service funded at present? (for example: research funding; State-based funding; self-funded by patients; no funding or payments):

TEER is not funded in Australia at present.

(Note. Except for limited ex-gratia funding by the private health insurers for the eligible patients in private sector as well as in public hospitals. Also, the Ratified PICO for the TTV replacement Application 1799 notes that TTV repair is currently used in public hospitals).

Please provide at least one proposed item with their descriptor and associated costs, for each population/Intervention:

The proposed MBS item for the TEER service is provided in Table 1. The proposed descriptor is broadly consistent with the eligibility criteria of the TRILUMINATE Pivotal trial.

Given the available comparative evidence of TEER versus OMT is limited to the TriClip™ system, and to date no RCT evidence exists for the PASCAL system, the proposed MBS item descriptor is not device agnostic rather specifies the TriClip™ device. This is consistent with the MitraClip™ device being included in the item descriptor for the TMVr procedure for functional mitral regurgitation (MBS item 38463).

Intermediate or high surgical risk was omitted from the descriptor (and from the proposed population) based on PASC's feedback in the Ratified PICO for Application 1799 for transcatheter tricuspid valve replacement. *"PASC discussed whether surgical ineligibility should be specified in the population, noting that isolated tricuspid valve surgery is a high-risk operation and surgical risk prediction tools are not accurate for assessing that risk. PASC acknowledged that clinical practice guidelines advise that surgery should be offered in patients with severe, symptomatic TR; however, current guidelines do not provide clear advice on patient selection nor the threshold for surgical intervention. PASC noted that surgeons are often reluctant to offer isolated tricuspid valve surgery because of the high mortality risk and uncertain outcomes in this cohort of patients. PASC decided that surgical ineligibility or risk should not be a criterion for the population and any decisions about suitability for surgical or transcatheter intervention should be at the discretion of the multidisciplinary heart team"* (Ratified PICO Application 1799 pg. 4).

The proposed fee for the TEER service is consistent with that of the TMVr procedure using the MitraClip device (38461), because the procedures are similar in terms of complexity, duration and resource utilisation.

Consistent with the MBS item for TMVr and the proposal for public funding TTV replacement as per Application 1799, new MBS items for TEER case conferences are proposed enabling suitability for TEER be established via a multidisciplinary heart team (Table 12).

Table 11 Proposed MBS item for TEER

Category number	3
Category description	Therapeutic procedure
Proposed item descriptor	<p>Transcatheter edge to edge repair (TEER), by transvenous techniques, for permanent coaptation of tricuspid valve leaflets using one or more Triclips™ including intraoperative diagnostic imaging if:</p> <p>(a) the patient has:</p> <p>(i) severe or greater tricuspid regurgitation, as determined by echocardiography;</p> <p>(ii) symptoms (New York Heart Association functional class II or greater) despite optimal medical therapy;</p> <p>(iii) left ventricular ejection fraction of 20% or more;</p> <p>(iii) systolic pulmonary artery pressure of less than 70mmHg, and</p> <p>(b) the patient is deemed suitable for TEER by a qualified multidisciplinary heart team, following a detailed assessment of comorbidities and expected benefits; and</p> <p>(c) the service is performed:</p> <p>(i) by an accredited interventional cardiologist or cardiothoracic surgeon trained and certified by the TEER accreditation committee;</p> <p>(ii) in a hospital accredited by the TEER accreditation committee to ensure appropriate facilities, personnel, and postoperative care; and</p> <p>(d) the service is not associated with a service to which item 38516, 38517 applies</p> <p>(H)</p> <p>Multiple Operation Rule (Anaes.) (Assist.)</p>
Proposed MBS fee	Fee: \$1,670.80 Benefit: 75% = \$1,253.10
Indicate the overall cost per patient of providing the proposed health technology	\$REDACTED
Please specify any anticipated out of pocket expenses	\$0
Provide any further details and explain	Out of pocket expenses are unknown. For breakdown of costs of the overall cost per patient of the TEER procedure, refer to TEER Cost Breakdown attachment.

Table 12 Proposed new MBS items for case conferences for TEER

MBS item number (where used as a template for the proposed item)	6082; 6084
Category number	1
Category description	PROFESSIONAL ATTENDANCE
Proposed item descriptor	MBS item YYYY Attendance at a TEER suitability case conference, by a cardiothoracic surgeon or an interventional cardiologist, to coordinate the conference, if: (a) the attendance lasts at least 10 minutes; and (b) the surgeon or cardiologist is accredited by the TEER accreditation committee to perform the service Applicable once per patient per lifetime
Proposed MBS fee	Fee: \$59.40 Benefit: 75% = \$44.55 85% = \$50.50
Proposed item descriptor	MBS item ZZZZ Attendance at a TEER suitability case conference, by a specialist or consultant physician, other than to coordinate the conference, if the attendance lasts at least 10 minutes Applicable once per patient per lifetime
Proposed MBS fee	Fee: \$44.30 Benefit: 75% = \$33.25 85% = \$37.70

Algorithms

Preparation for using the health technology

Define and summarise the clinical management algorithm, including any required tests or healthcare resources, before patients would be eligible for the proposed health technology:

The clinical management algorithm for patients with severe, symptomatic TR including TEER, has been Ratified by PASC in the 1799 MSAC Application for '*Transcatheter tricuspid valve replacement in patients with severe, symptomatic tricuspid regurgitation despite optimal medical therapy*'. Patients eligible for TEER using TriClip™ will undergo the same evaluation pathway to determine eligibility for treatment with a transcatheter intervention; thus, the clinical management algorithms provided in the Ratified PICO for Application 1799 remain mostly applicable to this current Application. To this end, the proposed algorithms in the PICO for Application 1799 have been adapted to the proposed population for TEER and is provided in Figure 3.

Relative to the clinical algorithm provided in the Ratified PICO for Application 1799, the following changes have been made in the clinical algorithm provided in this application in Figure 3 to align with the proposed population:

- an additional criterion is included whereby patients must have sPAP of <70 mmHg, and
- must have LVEF >20% (>25% in Application 1799).
- The proposed intervention is referred to as TEER in this application (TTV repair in Application 1799)

Patients will undergo testing to determine eligibility for TR intervention (surgical, transcatheter, or medical therapies) using the following:

- Initial clinical evaluation will be conducted by a GP, reviewing medical history for conditions associated with TR such as heart failure and other comorbidities
- Patient will undergo diagnostic imaging:
 - TTE for screening, used to evaluate valve structure and TR severity
 - TOE to confirm the diagnosis using detailed imaging, particularly when TTE results are inconclusive
 - [Note computer tomography would only be necessary for the determination of suitability for TEER versus TTV replacement].
- A multidisciplinary heart team (MDHT) will evaluate the patient's overall risk, anatomy, and suitability for further intervention.

The MDHT will also assess the patient for surgical risk using one of many available tools such as the EuroSCORE, the STS Risk Score, and the TRI-SCORE scoring system. However, as per the Ratified PICO for Application 1799, PASC noted that patients who are deemed appropriate for surgery may still not receive surgical intervention as: *"... [patients] may decline it, or not be offered it due to surgeon reluctance, given the high morbidity and mortality associated with isolated tricuspid valve surgical intervention and concerns around the reliability of surgical risk prediction tools in this patient cohort"* (pg. 15).

As a result, it is assumed that most patients will be assessed for suitability for transcatheter tricuspid valve intervention (TTVI). As noted in the PICO for Application 1799, standard practice determines that patients with severe, symptomatic TR may be considered for TEER (referred to as TTV repair in Application 1799). PASC noted that *"TTV repair is currently being undertaken in the public setting in Australia and to a limited extent in the private setting"*; and noted that *"the optimal TTVI approach would be determined by the multidisciplinary heart team on a case-by-case basis; some patients may be more suited to one technique than the other"* (pg. 15).

It is noted that although TTV replacement is not currently funded in Australia, it has been included in this clinical algorithm for completion due to the ongoing application status for the EVOQUE device in this setting (depicted as dotted box in algorithm).

Funding the proposed health technology, TEER, would increase the uptake of an intervention that is already being used, albeit to a limited extent, in the Australian public and private systems allowing equity in the access of this procedure.

Without the proposed health technology, a small proportion of patients would receive the intervention without reimbursement, thus paying out-of-pocket; while most patients would remain on OMT, continuing to receive suboptimal benefits and experience poor long-term outcomes.

Is there any expectation that the clinical management algorithm *before* the health technology is used will change due to the introduction of the proposed health technology?

No

Describe and explain any differences in the clinical management algorithm prior to the use of the proposed health technology vs. the comparator health technology:

N/A. The work up to determine suitability for TEER including tests and assessments are outlined above (and include medical history, imaging and MDHT).

Use of the health technology

Explain what other healthcare resources are used in conjunction with delivering the proposed health technology:

The following healthcare resources are used in conjunction with delivering the TEER procedure:

- TEER procedure cost (proposed MBS item fee)
- TriClip™ prosthesis
- Anaesthesia
- Intra-operative transoesophageal echocardiography
- Fluoroscopy
- Hospital associated costs

Explain what other healthcare resources are used in conjunction with the comparator health technology:

As the comparator is OMT, the key healthcare resources used to deliver this technology involve ongoing consultations with cardiologists and specialists, and pharmaceuticals.

Describe and explain any differences in the healthcare resources used in conjunction with the proposed health technology vs. the comparator health technology:

As outlined above, a number of healthcare resources are used in conjunction with TEER (including the procedure itself, the device, anaesthetics, imaging and hospitalisation associated resources), compared with the comparator, OMT, which requires ongoing consultation with specialists and pharmaceuticals. Notably, patients undergoing TEER will continue OMT after the procedure.

Clinical management after the use of health technology

Define and summarise the clinical management algorithm, including any required tests or healthcare resources, *after* the use of the proposed health technology:

According to the Applicant, follow up after TEER is as follows:

- Follow up echo (TTE) prior to discharge and then follow up every 1 to 2 years.
- Clinical manifestations of TR can be non-cardiac (tests may include ultrasound and blood tests to assess liver and kidneys).
- Continued use of diuretics post-procedure for some patients.

Define and summarise the clinical management algorithm, including any required tests or healthcare resources, *after* the use of the comparator health technology:

As specified in the Ratified PICO of Application 1799, patients who receive OMT require ongoing monitoring of weight, blood pressure and symptom exacerbation, alongside full blood tests for renal function and electrolytes.

Describe and explain any differences in the healthcare resources used *after* the proposed health technology vs. the comparator health technology:

The main difference in the healthcare resources used after TEER vs OMT is follow up TTE prior to discharge and then follow up every 1 to 2 years after the procedure.

Algorithms

Insert diagrams demonstrating the clinical management algorithm with and without the proposed health technology:

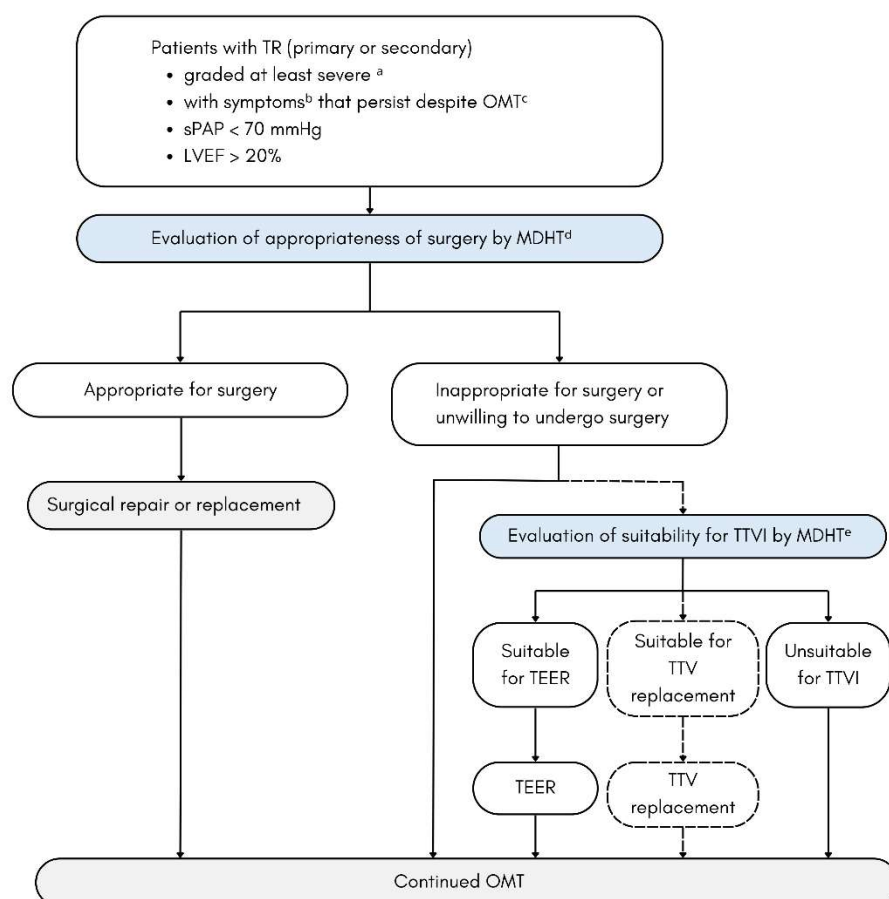


Figure 3 Clinical algorithm for tricuspid regurgitation (adapted from Figure 2 of Ratified PICO for Application 1799)

Abbreviations: LVEF, left ventricular ejection fraction; OMT, optimal medical management; sPAP, systolic pulmonary arterial pressure; TEER, transcatheter edge-to-edge repair; TR, tricuspid regurgitation; TTV, transcatheter tricuspid valve; TTVI, transcatheter tricuspid valve intervention
^a Severity determined by echocardiography using American Society of Echocardiography (ASE) grading
^b Symptomatic = NYHA Class II, III or ambulatory class IV

c OMT refers to stable diuretic therapy at a minimum

d Patients are considered for surgery by a multidisciplinary heart team, combining surgical risk assessment, frailty, major organ dysfunction and procedure-specific impediments

e Patients are considered for TEER based on clinical and technical factors.

Note: Although TTV replacement is not currently funded in Australia, it has been included in this clinical algorithm for completion due to the ongoing application status for the EVOQUE device in this setting.

Source: adapted from the Ratified PICO of MSAC application 1799

Claims

In terms of health outcomes (comparative benefits and harms), is the proposed technology claimed to be superior, non-inferior or inferior to the comparator(s)?

☒ Superior

☐ Non-inferior

☒ Inferior

Please state what the overall claim is, and provide a rationale:

Overall, the expected clinical claim is that relative to OMT, TEER + OMT is:

- Superior with respect to change in TR severity
- Superior with respect to mortality.
- Superior with respect to quality of life.
- Superior with respect to heart failure hospitalisation.
- Inferior with respect to safety such as procedural complications.

The primary end point from the TRILUMINATE Pivotal trial was a hierarchical composite that included death from any cause or tricuspid-valve surgery; hospitalisation for heart failure; and an improvement in quality of life as measured with the KCCQ, with an improvement defined as an increase of at least 15 points assessed at the 1-year follow-up. The primary endpoint was met and demonstrated that TEER + OMT was superior in terms of the hierarchical composite outcome compared to OMT alone, with a win ratio favouring the TEER + OMT group (1.48 [95% CI: 1.06, 2.13]; $p = 0.02$). The trial was not powered on the individual events included in the composite endpoint, nevertheless the ADAR will present individual events.

A statistically significant improvement in quality of life, as assessed by the KCCQ, was observed with TEER + OMT relative to OMT alone; with mean (\pm SD) change from baseline of 12.3 ± 1.8 points in the TEER + OMT group compared with 0.6 ± 1.8 points in the control group ($p < 0.001$).

As shown in Figure 4, whilst almost all subjects had severe TR at baseline, one year after intervention, the majority of TEER + OMT subjects were trace/mild/moderate (89%) the majority of OMT patients remained severe (95%).

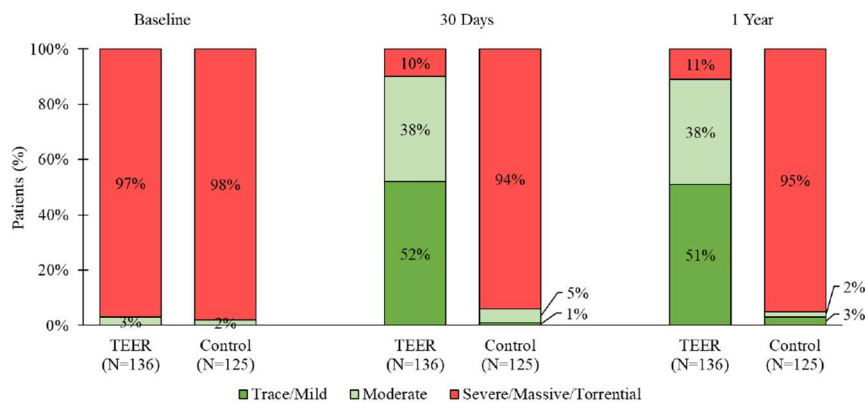


Figure 4 Severity of TR at baseline, 30 days and 1- year

Abbreviations: TEER, transcatheter edge-to-edge repair; TR, tricuspid regurgitation
Source: Sorajja 2023 Figure S4.

TR severity is strongly associated with mortality risk hence serves as a predictor of patient outcomes, including survival and quality of life (Nath 2004; Wang 2019). Studies have consistently demonstrated that as the severity of TR increases (from mild to moderate to severe), the risk of mortality also increases (Offen 2022; Topilsky 2014). This surrogate relationship between TR severity and mortality, has additionally been confirmed by four leading experts in the management of TR consulted in the preparation of this Application. The clinicians' advice is that reducing the severity of TR is the goal of treatment; hence TR severity is carefully evaluated when assessing a patient's prognosis and making treatment decisions. Results from a cohort of 439,558 individuals with at least one echocardiographic investigation from National Echocardiography Database of Australia (NEDA) showed that individuals with moderate and severe TR had a significant increase in the risk of all-cause mortality by 2.0-3.2-fold compared with those with no TR ($p < 0.001$ for both moderate and severe TR) (Offen 2022, **Error! Reference source not found.**). Similarly, in a study of 353 patients with isolated TR, the survival rate of individuals with moderate or less TR at 5 and 10 years (87% and 70%, respectively) far exceeded those of severe or greater TR (66% and 38% respectively) (Topilsky 2014, Figure 6).

Given the improvement in TR severity with TEER + OMT relative to OMT alone, and the relationship between increasing TR severity and mortality, it is expected that TEER + OMT will result in improved survival relative to OMT. The translation of TR severity to mortality will be conducted in the ADAR and incorporated in the economic evaluation.

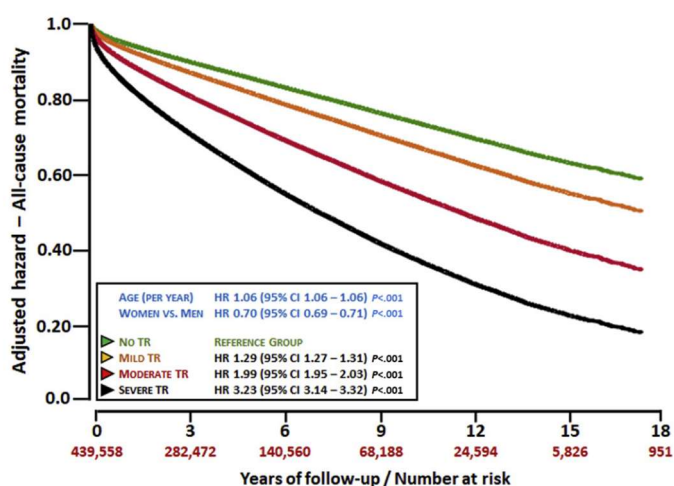


Figure 5 Long-term, all-cause mortality, according to TR severity

Abbreviations: CI, confidence interval; HR, hazard ratio; TR, tricuspid regurgitation
Source: Offen 2022, Figure 2

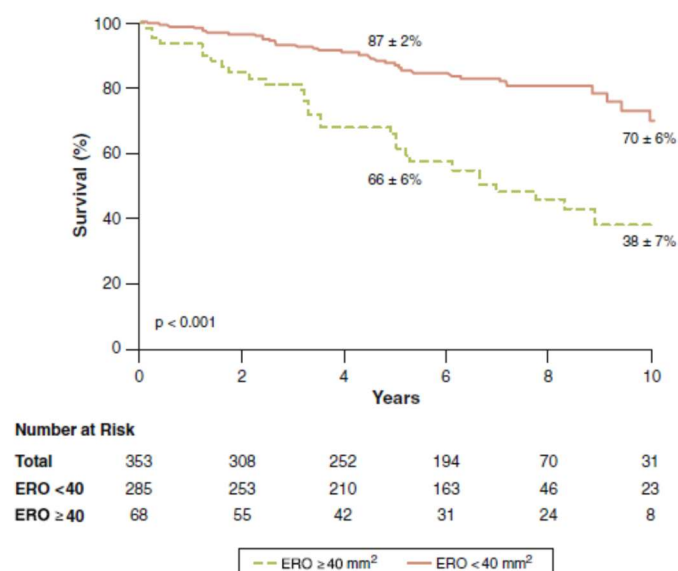


Figure 6 Survival in patients with isolated TR (stratified by severity)

Abbreviations: ERO, effective regurgitant orifice
Source: Topilsky 2014, Figure 1

The 2-year follow-up of TRILUMINATE Pivotal (Kar 2025) also showed that improvements in TR severity and quality of life were sustained through 2 years in TEER + OMT patients. Although 59% (n=142) crossed over from the OMT to TEER before the 2-year follow-up, results were maintained and TR severity was significantly reduced in the TEER group, with 84% of patients having moderate or less TR at 2 years. Improvement in health status assessed by the KCCQ was sustained through 2 years in the TEER group, with a 15.4±23.4–point improvement from baseline to the 2-year follow-up. Furthermore, a statistically significant difference in favour of TEER + OMT versus OMT alone was observed in the rate of heart failure hospitalisations at 2 years (p<0.05).

The claim of superior efficacy is further supported by the TRI-FR clinical trial (Donal 2025), a randomised (1:1) trial involving 300 patients with severe, symptomatic TR. The primary endpoint, a composite outcome, comprising change in NYHA class, change in patient global assessment, or occurrence of major cardiovascular events assessed during a 1-year period after randomisation. The score was a 3-level, ordered, categorical outcome, with each patient being classified as improved, unchanged, or worsened at each follow-up visit. The results from the primary endpoint statistically significantly favoured TEER (effect estimate = 0.67; 95% CI: 0.61, 0.72; $p < 0.001$). At 1 year, 109 patients (74.1%) in the TEER + OMT group had an improved composite score compared with 58 patients (40.6%) in the OMT-alone group. Massive or torrential TR was found in 6.8% of patients in the TEER group compared with 53.4% in the OMT group ($p < 0.001$). The absolute difference in mean (\pm SD) KCCQ score was 14.5 ± 27.2 points favouring TEER ($p < 0.001$).

In terms of safety, given TEER is an interventional procedure used upfront with ongoing OMT management, compared with continued OMT, it is concluded that TEER is inferior relative to OMT alone. Nevertheless, as per the TRILUMINATE Pivotal study, 98.3% of TEER patients were free from major adverse events at 30 days (exceeding the performance goal of 90%). The 2 year follow up of the TRILUMINATE Pivotal study support the longer-term safety of TEER. Adverse events through 2 years were generally infrequent and comparable to rates observed in the control group including stroke (1.9% vs 2.5%), transient ischemic attack (1.7% vs 1.0%), tricuspid valve surgery (2.3% vs 4.3%), cardiogenic shock (0.4% vs 1.3%), and new conduction disturbance requiring permanent pacemaker (7.4% vs 5.7%).

Identify how the proposed technology achieves the intended patient outcomes:

The TriClip device, used for transcatheter tricuspid valve repair, works by clipping together the leaflets of the tricuspid valve to reduce or prevent backward blood flow (regurgitation) from the right ventricle to the right atrium. This edge-to-edge repair technique aims to improve the valve's ability to close properly, thus reducing the workload on the heart. By approximating the leaflets, the clip reduces the amount of blood that leaks backward during ventricular contraction, hence improves TR severity, which in turn has positive implications on mortality and quality of life of the patient.

In terms of the immediate costs of the proposed technology (and immediate cost consequences, such as procedural costs, testing costs etc.), is the proposed technology claimed to be more costly, the same cost or less costly than the comparator? (please select your response)

More costly

Provide a brief rationale for the claim:

By definition, as the intervention is defined as TEER plus OMT, TEER will be associated with additional costs relative to the comparator of OMT alone. Additional costs include the costs of the TEER prosthesis, procedural based implantation costs including the cost of operating rooms and surgical staff, and post-implantation hospitalisation costs.

Summary of Evidence

Provide one or more recent (published) high quality clinical studies that support use of the proposed health service/technology. At 'Application Form lodgement', please do not attach full text articles; just provide a summary (repeat columns as required).

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Date of publication
1.	Prospective RCT TEER (TriClip) vs OMT; 1:1	TRILUMINATE Pivotal (NCT03904147) Sorajja (2023). Transcatheter repair for patients with tricuspid regurgitation.	<u>Population:</u> Severe tricuspid regurgitation, symptomatic (NYHA functional class II, III, or IVa), sPAP < 70 mmHg, who were receiving stable (≥ 30 days) guideline-directed medical therapy for heart failure, and had no other cardiovascular conditions in need of interventional or surgical correction. Patients must be of intermediate or greater surgical risk as determined by the local heart team (n=350). TEER group (N=175) OMT (N=175) Results Win ratio (a hierarchical composite that included death from any cause or tricuspid valve-surgery; hospitalisation for heart failure; and an improvement in quality of life defined as a ≥ 15 point increase in the KCCQ assessed at 1 year): 1.48 (95% CI: 1.06, 2.13); $p = 0.02$, favouring the TEER group TR severe, massive or torrential at 30 days: TEER 13.0% v OMT 95.2%; $p < 0.001$ <u>Results at 1 year TEER v OMT</u> Change in KCCQ score: 12.3 ± 1.8 v 0.6 ± 1.8 ; $p < 0.001$ Change in 6MWD: -8.1 ± 10.6 m v -25.2 ± 10.3 m; $p = 0.25$ Free from MAE at 30 days: 98.3% (TEER group)	https://www.nejm.org/doi/full/10.1056/NEJMoa2300525 (main trial publication) https://www.jacc.org/doi/10.1016/j.jacc.2024.08.044 (impact of renal and liver function) jacc.org/doi/10.1016/j.jacc.2024.09.009 (imaging sub study) jacc.org/doi/10.1016/j.jacep.2025.01.001 (patients with transvalvular cardiac implantable electronic device leads)	2023 2024 2025 2025

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Date of publication
		TRILUMINATE Pivotal (NCT03904147) Arnold (2024). Health status after transcatheter tricuspid-valve repair in patients with severe tricuspid regurgitation.	Measures quality of life using KCCQ and SF-36, and overall health status. An improved health status defined as KCCQ OS score ≥ 60 and no decline from baseline of >10 points at 1 year. Results <u>30 days</u> CFB KCCQ OS: TriClip 14.3 points v OMT 4.8 points CFB SF-36 physical component: TriClip 4.9 points v OMT 1.2 points CFB SF-36 mental component: TriClip 2.0 points v OMT 0.9 points <u>1 year</u> Alive and well: TriClip 74.8% v OMT 45.9% ($p < 0.001$) CFB KCCQ OS: TriClip 15.2 points v OMT 4.8 points CFB SF-36 physical component: TriClip 4.1 points v OMT -1.2 points CFB SF-36 mental component: TriClip 3.3 points v OMT 1.4 points	https://www.jacc.org/doi/10.1016/j.jacc.2023.10.008	2024

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Date of publication
		TRILUMINATE Pivotal (NCT03904147) Kar (2025). Two-year outcomes of transcatheter edge-to-edge repair for severe tricuspid regurgitation: the TRILUMINATE Pivotal randomised controlled trial.	Results (at 2 years) Annualised heart failure hospitalisation (HFH) HR: 0.72 (95% CI: 0.53, 0.98; p=0.04), favouring the TEER group Annualised rate of recurrent HFH: TEER 0.19 events per patient year (95% CI: 0.15, 0.23) v OMT 0.26 events per patient year (95% CI: 0.22, 0.31); p=0.02 Composite freedom from all-cause mortality, tricuspid valve surgery, and tricuspid valve intervention: TEER 77.6% (95% CI: 72.2, 82.1) v OMT 29.3% (95% CI: 23.8, 34.9), p<0.0001 Freedom from all-cause mortality: TEER 82.1% v OMT 82.9% Freedom from tricuspid valve surgery: TEER 97.7% v OMT 95.7% TR severity ≤ moderate: TEER 84% v pure OMT 21%	https://doi.org/10.1161/CIRCULATIONAHA.125.074536	2025

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Date of publication
2	Prospective RCT TEER vs OMT; 1:1	TRI-FR (NCT04646811) Donal (2025). Transcatheter edge-to-edge repair for severe isolated tricuspid regurgitation.	<i>Population:</i> Severe, symptomatic tricuspid regurgitation, NYHA functional class II-IV, despite stable (≥ 30 days) guideline-directed OMT for heart failure who are free from other cardiovascular conditions requiring intervention. Subjects must be ineligible for corrective action on valve by surgical approach (n=300). TEER+OMT (N=152) OMT-alone (N=148) Results Effect estimate of clinical composite score (comprising change in NYHA class, change in patient global assessment, or occurrence of major cardiovascular events assessed during a 12-month period after randomisation): 0.67 (95% CI: 0.61, 0.72); $p < 0.001$, favouring TEER Win ratio for composite secondary outcome (composite outcome of all-cause death, tricuspid valve surgery, KCCQ score improvement, or time to hospitalization for heart failure at 12 months): 2.06 [95% CI: 1.38, 3.08]; $p < 0.001$, favouring TEER <u>Results at 1 year TEER v OMT</u> TR Massive or torrential: 6.8% v 53.4%; $p < 0.001$ Mean KCCQ score: 12.3 ± 1.8 v 0.6 ± 1.8 . Absolute difference: 14.5 ± 27.2 points; $p < 0.001$, favouring TEER	https://jamanetwork.com/journals/jama/fullarticle/2827209	2025

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Date of publication
3	Prospective, single-arm trial	TRILUMINATE (NCT03227757) Nickenig (2019). Transcatheter edge-to-edge repair for reduction of tricuspid regurgitation: 6-month outcomes of the TRILUMINATE single-arm study.	<p><u>Population:</u> Moderate or greater tricuspid regurgitation, NYHA Class II or higher, and who were adequately treated per applicable standards (n=85).</p> <p>Results</p> <p>Reduction in tricuspid regurgitation severity by at least one grade at 30 days post-procedure: 71/83 (86%); 97.5% CI: 76%; p<0.0001</p> <p>MAE at 6 months post-procedure: 5/84 (6%); p<0.0001</p> <p>All-cause mortality: 4/84 (5%)</p> <p><u>TR reduced to moderate or less at:</u></p> <p>1 year: 40/63 (71%) (p<0.0001 compared to baseline)</p> <p>2 years: 29/48 (60%) (p<0.0001 compared to baseline)</p> <p>3 years: 79%</p> <p><u>All-cause mortality at:</u></p> <p>1 year: 6/84 (7.1%)</p> <p>2 years: 14/84 (18.7%)</p>	https://doi.org/10.1016/S0140-6736(19)32600-5 (6-month FU) https://doi.org/10.1016/j.jacc.2020.11.038 (1-year FU) https://doi.org/10.1161/CIRCINTERVENTIONS.122.012888 (2-year FU) https://doi.org/10.1016/j.jcin.2024.05.036 (3-year FU)	2019 2021 2023 2024

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Date of publication
4.	Prospective, single-arm, open-label, post-market registry	bRIGHT (NCT04483089) Lurz (2023). Short-term outcomes of tricuspid edge-to-edge repair in clinical practice.	<p><u>Population:</u> ≥ 18 years of age with severe, symptomatic TR despite medical therapy, eligible to receive TEER in subjects with endocardial leads (n=511).</p> <p>Results</p> <p><u>Results at 30 days post procedure</u></p> <p>Acute procedural success: 92.0% of subjects, meeting the performance goal of 75% (p<0.0001)</p> <p>Implantation success: 504/511 (99%)</p> <p>Procedural success: 451/496 (91%)</p> <p>TR severity moderate or less: 77% (compared with 2% at baseline).</p> <p>All-cause mortality: 5/511 (1%)</p> <p>MAE: 14/511 (2.5%)</p> <p><u>Baseline v 30-day results</u></p> <p>NYHA function class I/II: 20% v 79%</p> <p>KCCQ mean improvement: 19±23</p> <p><u>Baseline v 1 year results</u></p> <p>TR grade moderate or less: 12% v 81%</p> <p>NYHA class I/II: 21% v 75%</p> <p>KCCQ score improvement: 19±26 points; p<0.001</p>	https://www.jacc.org/doi/10.1016/j.jacc.2023.05.008 (30-days FU) https://www.jacc.org/doi/10.1016/j.jacc.2024.05.006 (1-year FU)	2023 2024

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Date of publication
5.	Patient registry	Pforzheim Tricuspid Valve Registry (NCT05179616) Patrascu (2022). Transcatheter tricuspid repair in prohibitive risk patients: impact on quality of life and major organ systems.	<p><i>Population:</i> Patients undergoing TTVR with the TriClip system, deemed to be ineligible for conventional surgery (N=33; expected to enrol 260). Divided into the following two subgroups: patients with prohibitive surgical risk (PR), and patients with high surgical risk (HR).</p> <p>Results</p> <p><u>Results at 30 days post procedure</u></p> <p>TR reduction of at least 1 grade: 93.9%</p> <p>Technical success: 100%</p> <p>NYHA functional class improvement: PR: 74%; HR: 60%</p> <p>6MWD increase: PR: 85.5±47.9m; HR: 81±43.6m</p> <p>KCCQ score improvement PR: 25.1±16.7 points; HR: 25.9±12.1 points</p> <p>All-cause mortality at 6 months: 12%</p>	https://doi.org/10.1016/j.cjca.2022.09.006	2022

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Date of publication
6.	Prospective, single-arm, multicentre, post-market, clinical follow-up study	TriCLASP (NCT04614402) Baldus (2022). Transcatheter valve repair of tricuspid regurgitation with the PASCAL system: TriCLASP study 30-day results.	<i>Population:</i> Patients eligible for percutaneous repair of TV insufficiency, with severe or greater TR on a 5-grade scale, eligibility and suitability to receive PASCAL system as determined by the local heart team. Results TR ≤moderate: discharge 90.7% v baseline 18.5% TR reduction of at least one grade at 30 days: 87.5% NYHA Class I or II: 30 days 55.8% v baseline 23.1% Change in 6MWD from baseline: 38.2 m Change in KCCQ from baseline: 13.4 points Implant success: 97.2% Procedural success: 77.8% Composite MAE rate at 30 days: 3.0% All-cause mortality rate at 30 days: 2.9% Heart failure rehospitalisation at 30 days: 4.5%	https://onlinelibrary.wiley.com/doi/10.1002/ccd.30450	2022
7.	Single-arm, multicentre, prospective study	CLASP TR (NCT03745313) Kodali (2021). Feasibility study of the transcatheter valve repair system for severe tricuspid regurgitation.	<i>Population:</i> Adults (≥ 18 years) with severe symptomatic TR despite OMT per the local heart team, and appropriate for transcatheter tricuspid repair. Results TR ≥severe: 30 days 48% v baseline 96% TR reduction of at least one grade at 30 days: 85% NYHA Class I or II: 30 days 89% v baseline 22% Composite MAE at 30 days: 5.9% All-cause mortality: 0% Heart failure rehospitalisation: 0% Implant success: 85.3% Procedural success: 80.0%	https://doi.org/10.1016/j.jacc.2020.11.047	2021

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Date of publication
		CLASP TR (NCT03745313) Kodali (2023). 1-year outcomes of transcatheter tricuspid valve repair.	Results TR reduction to ≤moderate: 30 days 70%; 1 year 86% TR reduction of at least one grade at 1 year: 100% NYHA Class I or II: 30 days 88%; 1 year 92% Change in 6MWD from baseline: 30 days 69 m; 1 year 94 m Change in KCCQ from baseline: 30 days 18 points Composite MAE: 30 days 9.2%; 1 year 16.9% All-cause mortality: 30 days 3.1%; 1 year 10.8% Heart failure rehospitalisation: 30 days 0%; 1 year 18.5% Implant success: 90.8% Procedural success: 87.5%	https://doi.org/10.1016/j.jacc.2023.02.049	2023

Abbreviations: 6MWD, 6-minute walk distance; AE, adverse event; CFB, change from baseline; FU, follow-up; HR, high surgical risk; KCCQ, Kansas City Cardiomyopathy Questionnaire; MAE, major adverse event; NYHA, New York Heart Association; OMT, optimised medical therapy; PR, prohibitive surgical risk; RCT, randomised controlled trial; sPAP, systolic pulmonary arterial pressure; TEER, tricuspid transcatheter edge-to-edge repair; TR, tricuspid regurgitation; TTVR, transcatheter tricuspid valve repair

* Categorise study design, for example meta-analysis, randomised trials, non-randomised trial or observational study, study of diagnostic accuracy, etc.

**Provide high level information including population numbers and whether patients are being recruited or in post-recruitment, including providing the trial registration number to allow for tracking purposes. For yet to be published research, provide high level information including population numbers and whether patients are being recruited or in post-recruitment.

Identify yet-to-be-published research that may have results available in the near future (that could be relevant to your application). Do not attach full text articles; this is just a summary (repeat columns as required).

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Status; Estimated completion
1.	TRICI-HF RCT vs OMT	TRICI-HF NCT04634266	This is a multicentre, randomised, prospective intervention study (N=360) designed to evaluate the effect of tricuspid valve intervention vs OMT in patients with symptomatic heart failure due to TR.	https://tric-i-hf.dzhk.de/ueber-die-studie/hintergrund-und-ziele/	Estimated completion: March 2027
2.	TRACE-NL RCT vs OMT	TRACE-NL NCT05628779	This is a national, multicentre, open-label RCT (N=~150) designed to show superiority of transcatheter tricuspid valve repair using the TriClip or PASCAL devices with OMT over OMT alone in patients with symptomatic, severe TR in the Netherlands.	https://clinicaltrials.gov/study/NCT05628779	Estimated completion: November 2027
3.	TRICARE Observational, comparative study vs OMT	TRICARE NCT06920745	This is a large coverage with evidence development, real-world evidence study (N=~2200) evaluating the long-term health outcomes of patients with symptomatic, severe or greater TR who received T-TEER procedure using the TriClip system.	https://clinicaltrials.gov/study/NCT06920745	Estimated completion: July 2032
4.	EuroTR Observational patient registry	EuroTR NCT06307262	This is a large patient registry (N=3000) recruiting patients who had undergone the T-TEER procedure using the TriClip or PASCAL devices, aiming to optimise patient selection prior to TTVT and thus treatment quality by collecting respective data in a real-world setting.	https://clinicaltrials.gov/study/NCT06307262	Estimated completion: December 2030
5.	Berlin Registry of Right Heart Interventions Observational patient registry	Berlin Registry of Right Heart Interventions NCT04570163	This is a patient registry (N=200) recruiting patients undergoing interventional therapies of right heart disease (including cardioband and TEER techniques of the tricuspid valve) performed in Berlin. The aim is to identify patient subgroups that benefit the most from this therapy.	https://clinicaltrials.gov/study/NCT04570163	Estimated completion: December 2025

	Type of study design*	Title of journal article or research project (including any trial identifier or study lead if relevant)	Short description of research (max 50 words)**	Website link to journal article or research (if available)	Status; Estimated completion
6.	CLASP II TR RCT vs OMT	NCT04097145	This is a prospective, multicentre, randomised, controlled pivotal trial (N=870) to evaluate the safety and effectiveness of TEER with the Edwards PASCAL Transcatheter Valve Repair System and OMT compared to OMT alone in patients with severe TR at intermediate or high risk of mortality with tricuspid valve surgery. Patients will be seen for follow-up visits at discharge, 30 days, 3 months, 6 months, and annually through 5 years.	https://clinicaltrials.gov/study/NCT04097145	Estimated completion: December 2027

Abbreviations: OMT, optimal medical therapy; RCT, randomised controlled trial; TEER, transcatheter edge-to-edge repair; TR, tricuspid regurgitation; TTVT, transcatheter tricuspid valve repair and replacement techniques

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