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Final Decision Analytic Protocol (DAP) to guide the assessment of transcatheter closure of patent ductus arteriosus

April 2013

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MSAC and PASC

The Medical Services Advisory Committee (MSAC) is an independent expert committee appointed by the Australian Government Health Minister to strengthen the role of evidence in health financing decisions in Australia. MSAC advises the Commonwealth Minister for Health on the evidence relating to the safety, effectiveness, and cost-effectiveness of new and existing medical technologies and procedures and under what circumstances public funding should be supported.

The Protocol Advisory Sub-Committee (PASC) is a standing sub-committee of MSAC. Its primary objective is the determination of protocols to guide clinical and economic assessments of medical interventions proposed for public funding.

Purpose of this document

This document is intended to provide a decision analytic protocol that will be used to guide the assessment of an intervention for a particular population of patients. The protocol has been finalised after inviting relevant stakeholders to provide input.

The protocol guiding the assessment of the health intervention has been developed using the widely accepted "PICO" approach. The PICO approach involves a clear articulation of the following aspects of the research question that the assessment is intended to answer:

Patients – specification of the characteristics of the patients in whom the intervention is to be considered for use;
Intervention – specification of the proposed intervention
Comparator – specification of the therapy most likely to be replaced by the proposed intervention
Outcomes – specification of the health outcomes and the healthcare resources likely to be affected by the introduction of the proposed intervention

Purpose of application

A proposal for an application requesting Medicare Benefits Schedule (MBS) listing of transcatheter closure of patent ductus arteriosus (PDA) for people with clinically significant PDA was received from the Cardiac Society of Australia and New Zealand by the Department of Health and Ageing in September 2012. The proposal relates to a procedure that has been established in the public health system in Australia since the 1990s, and that the CSANZ argues is standard therapy for treatment of PDA. However, there are no MBS items available for transcatheter closure of PDA.

Background

The ductus arteriosus is a vessel which is physiologically normal in utero providing a communication between the main pulmonary artery and descending aorta, allowing blood to mostly bypass the pulmonary circulation. In most newborns, as a result of both lung expansion and decrease in pulmonary vascular resistance that occurs at birth, the ductus arteriosus is usually substantially closed within 24 hours of birth and completely sealed after three weeks. PDA is a congenital disorder describing the failure of the ductus arteriosus to close and is either an isolated lesion or may be present in association with other defects. PDA affects females more often than males and may be more common in premature infants and those with neonatal respiratory distress syndrome (Medline 2009). When the PDA fails to close there is a persistent shunt from the aorta to the pulmonary artery which results in increased pulmonary blood flow and volume loading of the left atrium and left ventricle. Symptoms in children include:

- tachycardia
- respiratory problems including shortness of breath
- failure to thrive (US National Heart Lung and Blood Institute 2011a)
- heart murmur
- enlarged heart
- left sub-clavicular thrill
- bounding pulse and/or widened pulse pressure
- differential cyanosis
- hoarse cry or cough
- lower respiratory tract infections
- pneumonia
- atelectasis (Medscape 2012)

A PDA that persists into adult life can be associated with Eisenmenger's Syndrome, heart murmur, exercise intolerance, pulmonary hypertension, dilated left sided heart structures, atrial fibrillation and/or arrhythmia (Schneider et al 2006).

Patients who have clinically significant PDA with symptomatology of poor perfusion and cardiac failure require immediate intervention to avoid the ongoing effects of left to right shunting. Depending on the shape and size of the ductus, symptomatic patients may be treated either medically or surgically. Patients who are asymptomatic with clinically insignificant PDA may be monitored as outpatients but a subgroup of these patients may require subsequent intervention if significant left to right shunting emerges or is likely to emerge. Patients with 'ductal dependent' congenital heart anomalies and those associated with pulmonary vascular obstructive disease should not undergo closure (Rao 2007).

Incidence

In the United States, PDA occurs in 2 in every 1000 full term infants each year; it is more common in premature babies, with an average incidence of 8 in every 1000 premature births (US National Heart Lung and Blood Institute 2011b). European statistics indicate an incidence of 1 in 2000 full term infants. A higher prevalence is found in low birth weight premature babies (Orphanet 2009). According to the Applicant, PDA represents around 10% of the burden of congenital heart disease in Australia – the incidence of which is 1 in 100. Therefore the application estimates the incidence of PDA in Australia at around 1 in 1000. The Applicant indicates that there are 200-300 patients with PDAs that require closure in Australia each year.

However, according to the Australian Institute of Health and Welfare the rate of PDA in Australia is 16 per 10,000 (including live births and foetal deaths of at least 20 weeks gestation or at least 400 grams birth weight from all states and territories except the Northern Territory) (AIHW 2011). In 2003, the latest available incidence data, PDA was the second most commonly reported congenital heart condition with 406 cases. There were 550 procedures performed in 2009-10 for closure of patent ductus (AIHW 2009-10).

There is considerable debate in the literature over when a PDA should be treated; there have been trials of treatment approaches involving pre-symptomatic, symptomatic and prophylactic treatment (to reduce the risk of bacterial endocarditis). At present, the therapeutic options in Australia for PDA are medication (indomethacin or ibuprofen), surgery by open approach or minimally invasive video assisted surgery and transcatheter closure.

It is unclear how many of these patients may be managed with medication alone. At present medical devices used in transcatheter closure of PDA are unsuited to closure of very small and very large PDAs. Therefore the target population for this new procedure is a sub-group of the total number of patients with PDAs requiring closure.

Current arrangements for public reimbursement

At present, the majority of transcatheter procedures for closure of PDA are performed in the public sector. The AIHW data indicates that in 2009-10, of the 550 procedures performed for closure of PDA, 160 (29%) of these procedures were performed by percutaneous approach. Infants under 5 years of age accounted for 340 (87%) of a total of 390 surgical procedures and 91 (57%) of the percutaneous procedures. However, it should be noted that this data does not indicate whether the procedure for closure of PDA has been performed as a sole procedure or at the same time as other cardiac surgery.

There are no MBS items for transcatheter closure of PDA and the procedure has not been previously assessed by MSAC. However, medical devices to close the PDA have been listed on the Prostheses List for over seven years. Of these:

- two were listed prior to 2005;
- two were listed in July 2008; and
- three were listed in 2012.

Table 1: PDA Occluder Devices - Prostheses List

Code	Previous	Date	Product	Sponsor	Benefit
SJ260	ME065	Bef 2005	Amplatzer Duct Occluder	St Jude Medical Australia Pty Ltd	$10,200
SJ267	ME187	Bef 2005	Amplatzer Duct Occluder II	St Jude Medical Australia Pty Ltd	$10,200
DW001		Jul 2008	Nitinol spiral coil and delivery system for transcatheter occlusion of PDA	Denward Dell Pty Ltd TA Surimex	$1,900
DW002*		Jul 2008	Nitinol spiral coil and delivery system for transcatheter occlusion of PDA (medium)	Denward Dell Pty Ltd TA Surimex	$1,900
SJ280		Feb 2012	Amplatzer Duct Occluder II Additional Sizes	St Jude Medical Australia Pty Ltd	$10,200
WC294		Aug 2012	Flipper PDA Closure Detachable Coil Delivery System and Mreye Flipper PDA Detachable Embolisation Coil	Cook Medical Australia Pty Ltd	$600
WC295		Aug 2012	Mreye Flipper PDA Detachable Embolisation Coil	Cook Medical Australia Pty Ltd	$250

These devices are no-gap prostheses. This means that, assuming patients have appropriate health insurance, they will have no out-of-pocket expenses for the prosthesis. The health insurers are required to pay the benefit in full.

During the period in which these devices have been listed, private health insurance benefits have been paid for their use 63 times in the private sector.

Table 2: PDA Occluder Devices - Prostheses List – Usage 2006/08 to 2010/11

Casemix data	2006/08	2008/09	2009/10	2010/11
Total	16	14	21	12

Anecdotal evidence suggests that a small number of transcatheter PDA procedures may be being performed under certain peripheral transcatheter vascular MBS items (not the comparator items identified in this protocol). Therefore it is reasonable to assume that MBS benefits were claimed in association with these private services.

The AIHW data indicates that in 2009-10, only 10% (56) of PDA procedures were performed in private hospitals. However, the data does not provide a breakdown of the surgical approach used (AIHW 2008-09).

Regulatory status

The Therapeutic Goods Administration has provided regulatory approval for a range of trademarked PDA closure devices. Details regarding the listings on the Australian Register of Therapeutic Goods (ARTG) are provided in Table 3. The devices currently listed on the ARTG include Flipper coils (FC), Nit-Occlud coils (NOC), Amplatzer Duct Occluder (ADOI), Amplatzer Duct Occluder II (ADOII), Amplatzer Duct Occluder II-Additional Sizes (ADOII-AS). It should be noted that there are a couple of devices for PDA closure currently not listed on the ARTG but which are referred to in the international literature. These include Gianturco coils, the Rashkind PDA occluder (both older technologies) and the Occlutech PDA occluder (an emerging technology currently undergoing phase I trials) (Clinicaltrials.gov - identifier NCT01479218). According to the application, FC and ADO are the devices most commonly used in the current era.

Table 3: PDA Occluder Devices Listed on the ARTG

ARTG number	Sponsor name	Registered	ARTG label name	Functional description
162137	St Jude Medical Australia Pty Ltd	1 June 2009	AMPLATZER Cardiac Plug - Cardiac occluder	Cardiac occlude
134070	St Jude Medical Australia Pty Ltd	20 Dec 2006	AMPLATZER Duct Occluder - Cardiac occluder	Cardiac occlude
154956	St Jude Medical Australia Pty Ltd	5 Sept 2008	AMPLATZER Duct Occluder II - Cardiac occluder	Cardiac occlude
191422	St Jude Medical Australia Pty Ltd	2 Nov 2011	AMPLATZER Duct Occluder II Additional Sizes - Cardiac occlude	Cardiac occlude
188074	William A Cook Australia Pty	18 Aug 2011	Flipper 35 PDA Closure Detachable Coil Delivery System - Embolisation implant inserter	Embolisation implant inserter
194131	William A Cook Australia Pty	24 Jan 2012	MReye Flipper PDA Closure Detachable Coil - Embolisation implant, non-neurovascular	Embolisation implant, non-neurovascular
148233	Denward Dell Pty Ltd	6 Dec 2007	Nit-Occlud - Prosthesis, internal, embolisation, intravascular	Prosthesis, internal, embolisation, intravascular
162140	St Jude Medical Australia Pty Ltd	1 June 2009	AMPLATZER TorqVue 45 X 45 degree Delivery Sheath - Cardiac occluder delivery kit	Cardiac occluder delivery kit
134074	St Jude Medical Australia Pty Ltd	20 Dec 2006	AMPLATZER TorqVue Delivery System - Cardiac occluder delivery kit	Cardiac occluder delivery kit
134076	St Jude Medical Australia Pty Ltd	20 Dec 2006	AMPLATZER TorqVue Delivery System with Pusher Catheter - Cardiac occluder delivery kit	Cardiac occluder delivery kit
134075	St Jude Medical Australia Pty Ltd	20 Dec 2006	AMPLATZER TorqVue Exchange System - Cardiac occluder delivery kit	Cardiac occluder delivery kit
191136	St Jude Medical Australia Pty Ltd	27.10.2011	AMPLATZER TorqVue LP Catheter - Cardiac occluder delivery kit	Cardiac occluder delivery kit

ARTG: Australian Register of Therapeutic Goods

Patient population

Identifying patients suitable for transcatheter closure of PDA involves transthoracic echocardiography to determine whether the patent duct is suitable to be closed with a coil or occluding device. According to the applicant, there are broad clinical and echocardiographic features which support closure of the PDA with transcatheter techniques:

- Clinical signs of cardiac failure (failure to thrive, tachypnoea, hepatomegaly)
- The presence of typical a continuous murmur
- Echocardiographic evidence of left atrial and left ventricular dilatation
- Echocardiographic evidence of elevation of pulmonary artery pressures

Some of these patients may have previously trialled medication to close their ductus without success or were unable to receive medication due to a contraindication but medication has a limited role in PDA management. Some patients at the point of diagnosis may immediately proceed to transcatheter or surgical intervention if there is evidence of haemodynamic overload. Expert clinical advice is that the minimal indication for PDA closure is the presence of a continuous murmur. The presence of a continual murmur in the absence of heart failure does not preclude PDA closure, as there is an increased risk of sub acute bacterial endocarditis by leaving the ductus patent.

Patients who are potential candidates for transcatheter closure based the clinical and echocardiographic characteristics outlined above may still have characteristics which render them not suitable for transcatheter closure. According to the Applicant, patients weighing less than six (6) kilograms are usually considered unsuitable for the procedure in Australia. However, parental preference for surgery vs device closure, or cardiologist preference where the duct is large and the baby is small may factor into the decision making. Further, patient suitability for transcatheter closure is determined following an assessment of PDA anatomy. The shape of PDA varies considerably but most often it has a conical or funnel shape. The aortic end (ampulla) tends to be wide and gradually narrows towards the pulmonary end. The narrowest segment is usually at the pulmonary end but not always. PDA morphology is classified according to the Krichenko classification which is based upon angiographic appearance and includes Type A (conical), type B (window), type C (tubular), Type D (complex) and Type E (elongated) (Krichenko et al 1989). In relation to size, PDA with a minimal ductal diameter of <2 mm are generally regarded as small PDA and ducts with a minimal ductal diameter of 2-4 mm are regarded as medium size PDA and those >4mm classified as large PDA. However the cut off between what is regarded as small, medium to large varies across the literature. Further ductal length is sometimes measured to guide device selection.

The various devices available are designed to accommodate a variation of PDA size and morphology but generally speaking PDAs that are too small or too large in diameter or oddly shaped (non-conical or window like) tend to be unsuited for closure by transcatheter approach. For some of these patients surgical ligation may be the only alternative. There is no strict upper limit on ductal diameter over which transcatheter is no longer suitable as some larger PDAs may be shaped in a way that still make them amendable to transcatheter intervention. Vice versa, some smaller PDAs may not be suitable for transcatheter closure because neither a coil or occluding device are likely to neatly fit into the lumen of the ductus running the risk of protrusion into the pulmonary artery or the aorta.

However, overall it is difficult to be proscriptive regarding age, weight, size of duct etc. Clinical advice indicates that this is a decision best made by clinicians following a consideration of patient circumstances.

Intervention

Transcatheter closure of PDA is achieved by one of two methods and the choice of method of transcatheter closure appears to be based primarily on the shape of the PDA and minimal ductal diameter. In the first method, a platinum coil is deployed via a catheter through the femoral artery or femoral vein. This causes thrombosis leading to closure of the open duct. Coils tend to be used in smaller PDAs as the larger PDAs do not always have a significantly constricting neck to trap the body of the coil. In addition, larger PDAs are likely to require multiple coils which may potentially protrude into the lumen of the left pulmonary artery. In the second method, an occluder device is deployed

via a catheter through the pulmonary artery through the PDA. One end of the device hugs the walls of the PDA while the other rests on the aortic side to close the duct. More recent iterations of occluder devices have smaller retention discs than the older versions. The design of such devices is under constant review to maximise the benefit of closure and to minimise protrusion of the device into the adjacent pulmonary artery and aorta.

Delivery of the intervention

The procedure is usually performed in a biplane catheterisation laboratory of a large tertiary hospital. However a single plane laboratory may also be used. The staff required to undertake and monitor the patient during the procedure include a:

- paediatric (or adult) interventional cardiologist;
- paediatric and/or surgical assistant;
- nurse assistant to manage cardiac catheters;
- nurse scout;
- radiographer;
- anaesthetic consultant;
- anaesthetic assistant.

The attendant costs of the procedure relate to the costs of maintaining the equipment of a single plane or biplane catheter lab. The cost of the device used to close the PDA will also be included.

The Applicant indicates that the proposed service takes between one and two hours including anaesthetic time. The typical procedural time taken to perform transcatheter closure of a PDA would be 60 minutes. . According to the Applicant, complications occur at an incidence of approximately 1%. In the event of a complication, the procedure is significantly prolonged due to the requirement to retrieve the device. Additionally, any vascular occlusion of a femoral vessel may have significant implications for the patient including leg length discrepancy in later life.

This procedure requires an echocardiogram to define the exact anatomy of the PDA. In the paediatric setting, the procedure is usually performed under general anaesthetic. Children are generally admitted to hospital overnight for observation and they would have an echocardiogram and chest x-ray prior to discharge the following day. In the adult environment the procedure may be performed with sedation and local anaesthesia.

Transcatheter closure of a patent ductus arteriosus is a once off procedure resulting in closure of the PDA and resolution of the disease process. There are generally two follow up appointments and most children will be discharged from care one to two years following the procedure.

Most patients would be admitted on the morning of the procedure, following assessment at a preadmission clinic and discharged the following day.

Prerequisites

The Applicant indicates that the procedure should be performed by a credentialed Paediatric Interventional Cardiologist or Adult Interventional Cardiologist. In the guidelines for paediatric cardiac catheterisation, closure of an uncomplicated PDA is classified as a level 2 procedure, while closure of a PDA in a patient of less than 10kg is classified as a level 3 procedure. The Applicant recommends that cardiothoracic surgical back up should be available to the catheter lab where these procedures are performed in case surgical intervention is needed and that this procedure should only be funded for services delivered by the designated provider. The Applicant indicates that the current staffing numbers and skill sets within cardiac catheter labs are appropriate for these procedures. The catheter equipment required to perform this procedure is standard equipment present in all cardiac catheter laboratories.

As patients diagnosed with this condition who live in regional or rural areas will need to travel some distance for treatment, the Applicant indicates that there will be a need for patient travel to be supported by the various state and territory patient travel assistance schemes.

Co-administered and associated interventions

Under normal circumstances, a patient with a suspected PDA will be referred to a paediatric cardiologist. During this consultation the cardiologist will consider the patient's symptoms and perform a physical examination and a range of diagnostic tests to determine whether transcatheter or surgical closure is more appropriate. These include:

- CT aortogram;
- chest X-ray and/or radiography;
- transthoracic echocardiogram (MBS item 55113; 55115);
- ECG;

If the patient's presentation is unusual or if there are other congenital cardiac abnormalities revealed by the diagnostic testing, right and left heart catheterisation may also be indicated.

Once it is established that the PDA is suitable for closure by transcatheter approach, the patient will be referred to an interventional cardiologist (paediatric or adult). A pre-surgical consultation will occur and a transthoracic echocardiogram (MBS items 55113; 55115) will be performed to establish the exact size and shape of the PDA. This is likely to be on the day of the procedure. Following deployment of the device, another echocardiogram is performed to ensure shunt closure. During surgery the shortest duration of radiation exposure for fluoroscopy is in the range of five (5) minutes; should complications occur it can be up to thirty (30) minutes. Paediatric patients usually stay overnight in hospital and a further echocardiogram is performed prior to discharge.

Listing proposed and options for MSAC consideration

Proposed MBS listing

The Applicant has not provided a detailed MBS item descriptor but has indicated a Schedule fee of $963.90 for transcatheter closure of PDA. No explanation has been specifically given for this figure. However, the Applicant has indicated that the technique involved in the procedure and the devices utilised most closely resemble those of MBS item 38272 which covers transcatheter closure of Atrial Septal Defect (ASD). MBS item 38272 has a schedule fee of $912.30 as of 1 November 2012. Clinical advice indicates the proposed MBS listing should only attract a 75% benefit given transcatheter cardiac procedures (be they for PDA, ASD etc) will only be performed on inpatients.

Table 4: Current MBS item descriptor for 38272

Category 3 – Cardio-Thoracic
MBS 38272 Atrial septal defect closure, with septal occluder or other similar device, by transcatheter approach (Anaes.) (Assist.) Fee: $912.30 Benefit: 75% = $684.25 85% = $837.80

Clinical place for proposed intervention

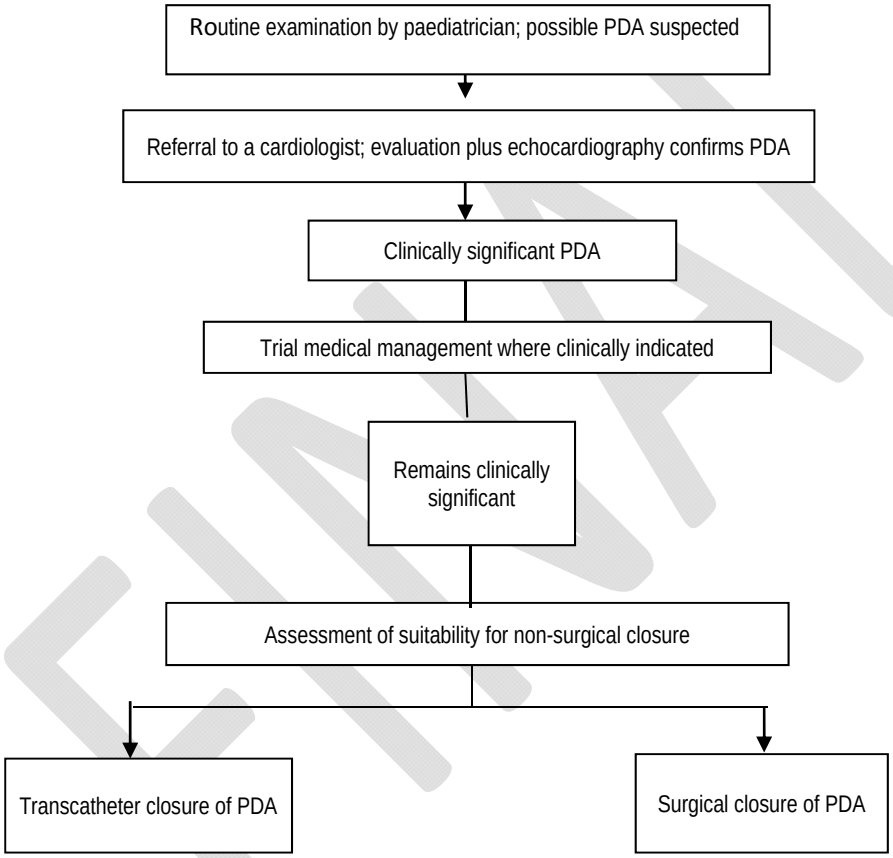
Management of PDA currently varies. Premature infants may receive medical management i.e. Indomethacin with a view to achieving closure of PDA. Asymptomatic neonates may be monitored as outpatients, while symptomatic patients, depending on the onset and severity of the symptoms, PDA can be treated medically or surgically subject to the severity of the opening. Paediatric patients generally present with tachycardia, breathlessness and/or respiratory problems and poor feeding. Diagnosis is by echocardiogram and in most neonatal intensive care units in Australia the first line medical therapy for symptomatic PDA is usually 'long courses' of indomethacin (Hoellering et al 2009). Surgery is considered if the PDA fails to close or reopens following the medical therapy. Traditionally, surgical ligation of the PDA involves a thoracotomy and dissection and ligation of the PDA. The PDA may also be clamped, oversewn or clipped.

Another emerging minimally invasive option is video assisted thoracoscopic surgery (VATS). It is not clear if thoracoscopy provides shorter hospital stays or decreases costs. Additionally, thoracoscopy is contraindicated for adults with calcified PDA. Because of the limited control and visualisation available, thoracoscopy in neonates is not widely advocated; it appears to have no definite advantage, given that the open procedure uses such a small incision. Clinical advice indicates that in Australia, the video assisted thoracoscopic approach is not used for paediatric patients.

The current clinical management algorithm for diagnosing and treating patients with PDA at is illustrated in Figure 1. Given transcatheter closure has been established for some time in the

Australian health care setting, only one clinical management algorithm is presented. It should be noted that the clinical assessment in which patients are selected for either transcatheter or surgical closure of their PDA may be occurring during their initial presentation. The diagram below illustrates this as sequential but in clinical reality many clinicians are ascertaining the characteristics of the PDA immediately on referral.

Figure 1: Broad representation of the clinical management algorithm for diagnosis and treatment of PDA currently in Australia



The Applicant claims transcatheter closure is a direct substitute (i.e. provides patients with a new treatment alternative) for the currently subsidised intervention of surgical ligation of PDA. However, it should be noted that there are some patients for whom transcatheter closure is not an option, such as very small patients and those with very large PDAs.

Comparator

According to the Applicant, the transcatheter closure of PDA is a direct substitute for surgical ligation of PDA without cardiopulmonary bypass (MBS item 38700) and thus surgical closure is proposed by the applicant as being the appropriate comparator. The Schedule fee for MBS item 38700 as of 1 November 2012 is $1,067.40 which excludes transcatheter techniques.

Surgical closure of PDA has attracted medical benefits for several decades in Australia. Surgical closure with PDA can also be performed with cardiopulmonary bypass (MBS item 38703 – Schedule fee $1,924.10). Both 38700 and 38703 attract a 75% MBS benefit only. However MBS item 38703 is not an appropriate comparator for transcatheter closure of PDA as it is a more complex procedure usually performed with other cardiac procedures.

Table 5: Current MBS item descriptor for 38700

Category 3 – Cardio-Thoracic
MBS 38700 Patent ductus arteriosus, shunt, collateral or other single large vessel, division or ligation of, without cardiopulmonary bypass, for congenital heart disease (H) Anaes.) (Assist.) Fee: $1,067.40 Benefit: 75% = $800.55 T.8.69 Cardiac and Thoracic Surgical Items Items 38470 to 38766 must be performed using open exposure or minimally invasive surgery which excludes percutaneous and transcatheter techniques unless otherwise stated in the item.

The utilisation rates for the current MBS items for surgical closure of PDA, without cardiopulmonary bypass, are low. In 2011-12 there were only 41 procedures in total performed. However, the Department is aware that a small number of transcatheter PDA procedures are being performed inappropriately at present, under certain percutaneous vascular MBS items. In 2010-11 private health insurance benefits were paid for 12 PDA devices listed on the Prostheses List. It may be reasonable to assume that MBS benefits were claimed for these procedures.

Table 6: MBS item 38700 – Usage 2007/08 – 2011/12

MBS data	2007/08	2008/09	2009/10	2010/11	2011/12
38700	52	49	38	49	41

An analysis of MBS expenditure data for 2007-08 to 2011-12 indicates that the surgical closure of PDA (MBS item 38700) has not been bulk-billed during that period. Table 7 shows fees charged, MBS benefits paid and patient contribution for this period. However, Medicare statistics do not include data relating to supplementary payments to patients from private health insurance funds. As a consequence, patient contributions may be over-stated.

Table 7: MBS Item 38700: 2007-08 to 2011-12 Total Services, Fees Charged, Benefits Paid and Patient Contribution

MBS Item 38700				
	Services	Fees Charged	Benefits Paid	Patient Contribution
	Numbers	($)	($)	($)
2011-12	41	37,133	19,839	10,682
2010-11	49	51,684	27,507	15,010
2009-10	38	38,078	19,408	12,201
2008-09	49	48,613	24,929	15,376
2007-08	52	49,934	27,119	13,778

Although the literature indicates that PDA occurs at a ratio of approximately 2:1 in females to males, this is not reflected in the use of item 38700 (Table 8). However, this may be due to the reluctance in the Australian setting to resort to surgery.

Table 8: MBS Item 38700: 2007-08 to 2011-12 Total Services by gender

MBS item 38700					
	2011-12	2010-11	2009-10	2008-09	2007-08
males	25	20	18	24	25
females	16	29	20	25	27

Transcatheter closure is identified by the Applicant as a direct substitute for MBS item 38700, surgical closure of PDA without cardiopulmonary bypass. Table 9 provides an age breakdown of the provision of services for the period 2007-08 to 2011-12 for MBS item 38700. Of the 229 services provided over the past five years, 83 per cent have been provided to children aged 0-4 years. It should be noted that clinical issues and expectations are different for paediatric vs adult patients.

Table 9: MBS Item 38700: 2007-08 to 2011-12 Total Services by Age

	2011-12	2010-11	2009-10	2008-09	2007-08
0-4 years	34	46	30	39	41

Clinical claim

As the medical devices to close the PDA are deployed via transcatheter approach, it is possible to avoid a thoracotomy and dissection of friable ductus tissue. As such, it is proposed that treatment via transcatheter closure of PDA may have an arguably lower complication rate, less patient discomfort and shorter patient hospital stays and thus a more favourable safety profile.

The overall clinical claim in terms of clinical effectiveness is that transcatheter closure of PDA will achieve the same long term patient outcome as achieved by surgical ligation (non-inferiority). However, the Applicant indicates that the transcatheter approach may have possible advantages but

the applicant is not explicitly putting forward a therapeutic claim of superiority. The economic evaluation will be based on a cost effectiveness or cost-utility analysis (see Table 10 for details).

Table 10: Classification of an intervention for determination of economic evaluation to be presented

		Comparative effectiveness versus comparator					
		Superior		Non-inferior	Inferior		
Comparative safety versus comparator	Superior	CEA/CUA		CEA/CUA	Net clinical benefit	CEA/CUA	
					Neutral benefit	CEA/CUA*	
					Net harms	None^	
	Non-inferior	CEA/CUA		CEA/CUA*	None^		
	Inferior	Net clinical benefit	CEA/CUA	None^	None^		
		Neutral benefit	CEA/CUA*				
		Net harms	None^				

Abbreviations: CEA = cost-effectiveness analysis; CUA = cost-utility analysis

* May be reduced to cost-minimisation analysis. Cost-minimisation analysis should only be presented when the proposed service has been indisputably demonstrated to be no worse than its main comparator(s) in terms of both effectiveness and safety, so the difference between the service and the appropriate comparator can be reduced to a comparison of costs. In most cases, there will be some uncertainty around such a conclusion (i.e., the conclusion is often not indisputable). Therefore, when an assessment concludes that an intervention was no worse than a comparator, an assessment of the uncertainty around this conclusion should be provided by presentation of cost-effectiveness and/or cost-utility analyses.

^ No economic evaluation needs to be presented; MSAC is unlikely to recommend government subsidy of this intervention

Outcomes and health care resources affected by introduction of proposed intervention

Outcomes

Potential outcomes for the comparison of relative clinical effectiveness include, but are not limited to:

- successful duct closure without evidence of residual shunt closure after 1 year confirmed by echocardiogram; equivalent long term outcome to surgical ligation;
- resolution of disease process (absence of cardiac failure);
- vascular occlusion;
- tachyarrhythmia;
- bradyarrhythmias;
- patient mortality;
- procedure time;
- duration of hospitalisation post-procedure;
- recovery time post-procedure.

Potential major adverse events that are of interest for the comparison of relative safety of transcatheter closure of PDA and PDA surgical ligation include but are not limited to:

- patient mortality;
- vascular occlusion of a femoral vessel;

- infection;
- bleeding at catheterisation site;
- re-operation for failed transcatheter deployment of device;
- tachyarrhythmia;
- bradyarrhythmias;
- recurrent laryngeal nerve injury;
- incidence of device complications including but not limited to:
    - unable to achieve stable position;
    - migration/dislodgement/protrusion of device;
    - device embolisation;
    - obstruction of aorta or pulmonary artery by device;
    - inappropriate deployment of device;
    - rupture of blood vessels.

Health care resources

Details on the health care resources required should transcatheter closure of PDA be made available are listed in Table 11.

Table 11: List of resources to be considered in the economic analysis (based on 2011-12 financial year)

	Provider of resource	Setting in which resource is provided	Proportion of patients receiving resource	Number of units of resource per relevant time horizon per patient receiving resource	Disaggregated unit cost					
					MBS Schedule fee***	Safety nets*	Other govt budget	Private health insurer	Patient**	Total cost
Resources provided to identify eligible population should intervention be made available as proposed										
CT aortogram	Cardiologist	Diagnosis	TBD	TBD	TBC					
Transthoracic echocardiography	Cardiologist	Diagnosis	TBD	TBD	$230.65 (55113) (55114); (55115)	TBD	$0.00	$0.00	$94.00 $108.10	$324.65 $338.75
Chest x-ray	Cardiologist	Diagnosis	TBD	TBD	$47.15 (58503)	TBD	$0.00	$0.00	$19.00	$66.15
ECG	Cardiologist	Pre-delivery	TBD	TBD	$31.25 (11700) $15.55 (11701) $15.55 (11702)	TBD	$0.00	$0.00	$15.00 $8.00 $5.00	$46.25 $23.55 $20.55
Cardiac catheterisation	Cardiologist	Pre-delivery	TBD	TBD	$531.55 (38203) $642.65 (38206)	TBD	$0.00	$0.00	$259.00 $176.00	$790.55 $818.65
Cardiology consult	Cardiologist	Diagnosis	TBD	TBD	$85.55 (104)	TBD	$0.00	$0.00	$59.00	$144.55
Surgical consult	Surgeon/ Cardiologist	Pre-delivery	TBD	TBD	$85.55 (104)	TBD	$0.00	$0.00	$58.00	$143.55
Anaesthetic consult	Anaesthesiologist	Pre-delivery	TBD	TBD	$118.80 (20520)	TBD	$0.00	$0.00	$164.00	$282.80
Resources provided to deliver proposed intervention										
Surgery (incl surgeon)	Cardio-thoracic surgeon	Delivery	TBD	TBD	$963.90 (CSANZ)	$0.00				
Surgical assistant	Cardio-thoracic	Delivery	TBD	TBD	derived fee	$0.00	$0.00	$0.00		

	Provider of resource	Setting in which resource is provided	Proportion of patients receiving resource	Number of units of resource per relevant time horizon per patient receiving resource	Disaggregated unit cost					
					MBS Schedule fee***	Safety nets*	Other govt budget	Private health insurer	Patient**	Total cost
	surgical trainee				(51303)					
Prosthetic device	Surgeon / cardiologist	Delivery	TBD	TBD	$0.00	$0.00	$0.00			$10,200 (occluder) $1,900 (spiral coil) $600 (flippercoil)
Nurse Assist (2)	Hospital	Delivery	TBD	TBD	NA	$0.00	$140.00			
Anaesthesiology	Anaesthesiologist	Delivery	TBD	TBD	$118.80 (21936)	$0.00	$0.00	$0.00	$195.00	$313.80
Catheterisation lab	Hospital	Delivery	TBD	TBD	$0.00	$0.00				
Cardiac ward	Hospital	Delivery	TBD	1 day	$0.00	$0.00				
Pharmaceuticals	Hospital	Delivery	TBD	TBD	$0.00	$0.00		$0.00		
Transthoracic echocardiography	Echocardiographer	Pre & post discharge	TBD	TBD	$275.50 (55118)	$0.00			$147.00	
Chest x-ray	Radiographer	Pre discharge	TBD	TBD	$47.15 (58503)	$0.00			$19.00	$66.15
Cardiology consult	Cardiologist	Pre & post discharge	TBD	TBD	aftercare	$0.00	$0.00	$0.00	$0.00	$0.00
Resources provided post procedure										
Cardiology consult	Cardiologist	Post procedure	TBD	6wks to2yrs	$43.00 (105)	TBD	$0.00	$0.00	$59.00	$102.00
Transthoracic echocardiography	Echocardiographer	Pre & post discharge	TBD	TBD	$275.50 (55118)	$0.00			$147.00	
Resources provided to identify eligible population for comparator (current scenario)										
Cardiology consult	Cardiologist	Diagnosis	TBD	TBD	$85.55 (104)	TBD	$0.00	$0.00	$58.00	$143.55
Transthoracic echocardiography	Echocardiographer	Pre & post discharge	TBD	TBD	$275.50 (55118)	$0.00			$147.00	
Surgical consult	Interventional cardiologist	Pre-delivery	TBD	TBD	$85.55 (104)	TBD	$0.00	$0.00	$58.00	$143.55
Anaesthetic consult	Anaesthesiologist	Pre-delivery	TBD	TBD	$118.80 (20520)	TBD	$0.00	$0.00	$164.00	$282.80
Resources provided to deliver comparator										
Surgical ligation	Interventional cardiologist	Delivery	TBD	TBD	$1,067.40 (38700)	$0.00			$422.00	$1489.40
Surgical assistant	Cardiology trainee or registrar	Delivery	TBD	TBD	derived fee (51303)	$0.00				
Transthoracic echocardiography	Echocardiographer	Pre & post discharge	TBD	TBD	$275.50 (55118)	$0.00			$147.00	
Anaesthesiology	Anaesthetist	Delivery	TBD	TBD	$118.80 (21936)	$0.00			$195.00	$313.80
Pathology	Pathologist	Delivery	TBD	TBD	$0.00	$0.00	TBD	TBD	TBD	
Blood transfusion	Anaesthetist	Delivery	TBD	TBD	$0.00	$0.00	TBD	TBD	TBD	
Pharmaceuticals	Hospital	Delivery	TBD	TBD	$0.00	$0.00	TBD	TBD	TBD	
Intensive care unit	Hospital	Delivery	TBD	1 day	$0.00	$0.00	TBD	TBD	TBD	
Cardiac ward	Hospital	Delivery	TBD	3-4 days	$0.00	$0.00	TBD	TBD	TBD	
Resources provided in association with comparator										
Blood bank	TBD	Delivery	TBD	TBD						TBD
Resources provided post procedure for comparator										
Cardiology consult	Cardiologist	Post procedure	TBD	Up to 2yrs	$43.00 (105)	TBD				
Transthoracic echocardiography	Echocardiographer	Pre & post discharge	TBD	TBD	$275.50 (55118)	$0.00			$147.00	

* Include costs relating to both the standard and extended safety net; ** Based on patient data for the 2011-12 financial year. Average fee charged minus average non-bulk billed benefit; *** MBS Schedule Fee as at 1 November 2011.

Proposed structure of economic evaluation (decision-analytic)

The PICO criteria for the evaluation are provided in Table 12.

Table 12: Summary of extended PICO to define research questions that assessment will investigate

Patients	Intervention	Comparator	Outcomes to be assessed
Patients with clinically significant PDA (identified by transthoracic echocardiography)	Transcatheter closure of PDA	Surgical closure of PDA	Effectiveness (including but not limited to: • successful duct closure • no residual shunt detected • equivalent long term outcome to surgical ligation • resolution of disease process (absence of cardiac failure) • vascular occlusion • patient mortality • procedure time • duration of hospitalisation post-procedure • recovery time post-procedure Safety (including but not limited to): • patient mortality • vascular occlusion of a femoral vessel • infection • bleeding at catheterisation site • re-operation for failed transcatheter deployment of device • recurrent laryngeal nerve injury • incidence of device complications including but not limited to: - unable to achieve stable position - migration/dislodgement/protrusion of device - obstruction of aorta or pulmonary artery by device - device embolisation - inappropriate deployment of device - rupture of blood vessels - tachyarrhythmia/bradyarrhythmia

Clinical research questions for public funding

1. In the treatment of patients with clinically significant patent ductus arteriosus, what is the safety, effectiveness and cost effectiveness of transcatheter closure of the patent duct compared to surgical ligation?

Decision analytic diagram

The decision analytic for the surgical closure of PDA pathway is presented in Figure 2, while the proposed decision analytic pathway for patients suitable for transcatheter closure of PDA is presented in Figure 3.

Figure 2: Decision analytic pathway for surgical closure of PDA

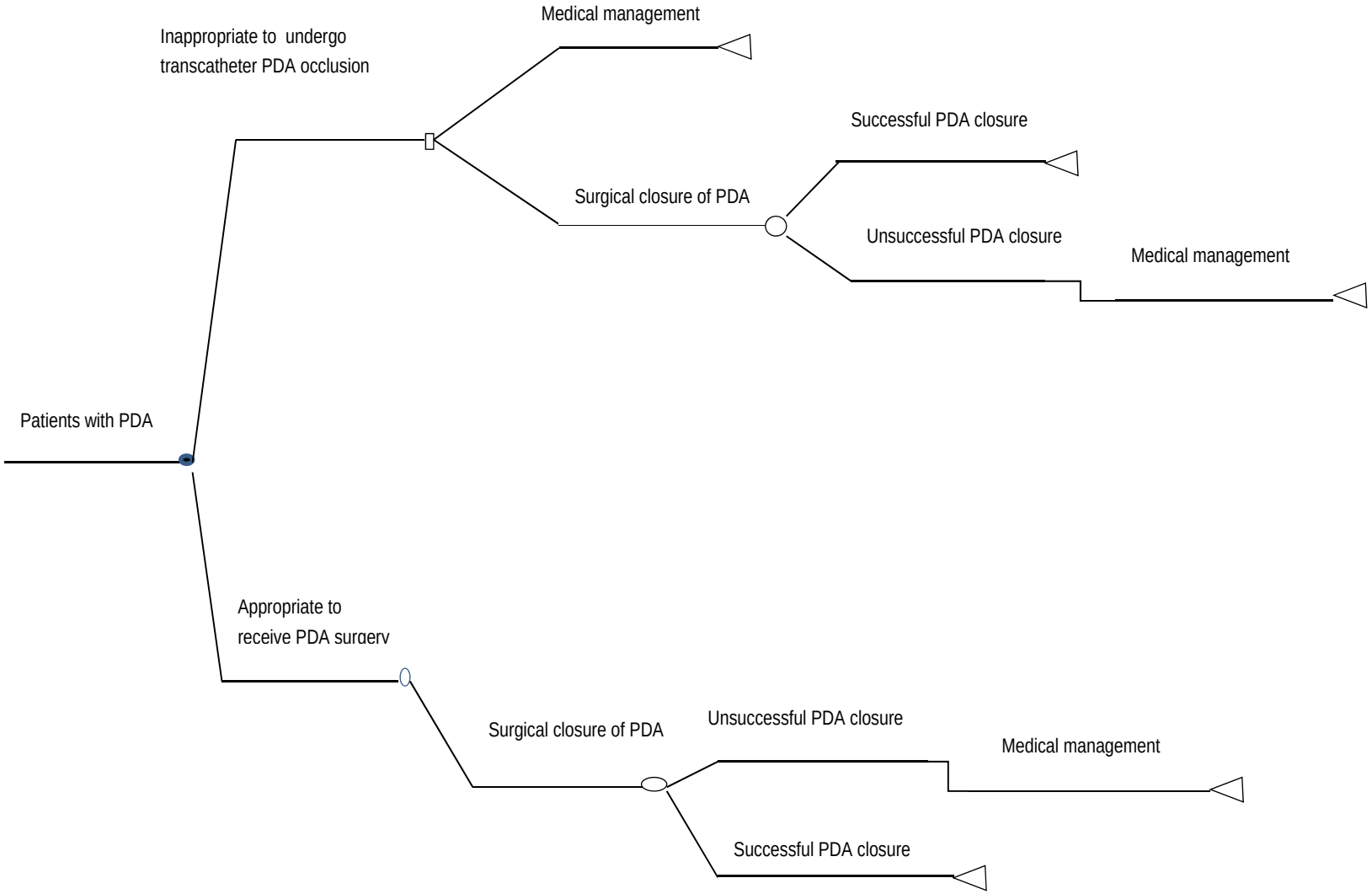
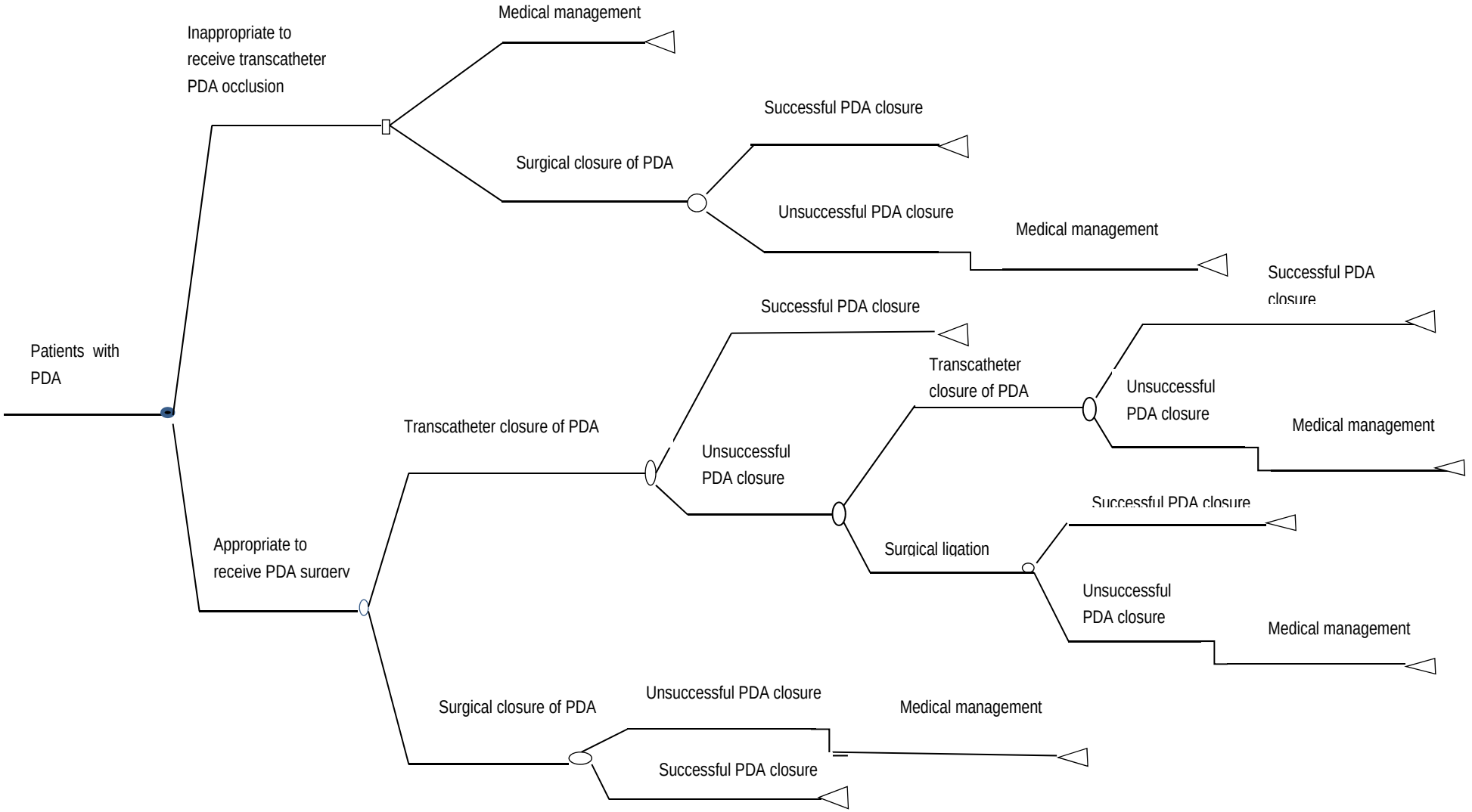


Figure 3: Decision analytic pathway for patients suitable for transcatheter closure of PDA



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AIHW Table 1 and 2: Selected separation statistics(a) for procedures in ACHI blocks, public and private hospitals, Australia, 2008-09.

AIHW procedures datacubes

Casemix data

AIHW Table 2: Selected separation statistics(a) for procedures in ACHI blocks, private hospitals, Australia, 2008-09.

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Information on state and territory travel schemes can be found at http://www.wacountry.health.wa.gov.au/index.php?id=pats; http://www.health.nt.gov.au/Hospitals/Patient_Assistance_Travel_Scheme; http://www.dhhs.tas.gov.au/ambulance/ptas; http://www.countryhealthsa.sa.gov.au/Services/PatientAssistanceTransportSchemePATS.aspx; http://www.health.nsw.gov.au/transport/Pages/default.aspx; http://www.health.vic.gov.au/ruralhealth/vptas/; http://access.health.qld.gov.au/hid/HealthConsumerInformation/TravelHealth/patientTravelSubsidySchemeEligibility_ap.asp; [accessed 15 November 2012]

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