Leading Article

Treatment of Congenital Heart Defects Using Interventional Catheterization

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At present, several types of congenital heart defects (CHDs) can be treated using interventional cardiac catheterization (ICC) techniques [1]. Following the initial use of balloon atrial septostomy in the transposition of the great arteries in 1966 [2], there was a delay of almost 15 years before ICC procedures began to progress rapidly. The role of ICC techniques has evolved from replacing surgery altogether in some cases to complementing it in others [3]. Interventional approaches offer several advantages over surgery, including the avoidance of cardiopulmonary bypass, the absence of thoracic scars, and a shorter hospital stay [4]. However, many CHDs remain in which only certain components can be treated or palliated using ICC while the other components must be managed surgically; in such cases, ICC serves to complement the surgical procedure. For the treatment of some defects, a hybrid approach may be needed, in which a surgeon and cardiologist perform the procedure together in the catheter laboratory or cardiac theatre [5,6].

Approaches for ICC

The access for ICC procedures is similar in children and adults. In the majority of ICC procedures for CHDs, the most frequently used approach is via the femoral vein or the femoral artery. When the antegrade femoral venous approach is used, access can be obtained via the inferior caval vein and the right heart into the pulmonary arteries, or through the foramen ovale (if patent) into the left heart. If the inferior caval vein is obstructed or occluded, or if there is azygos continuation, either the jugular venous, or a transhepatic venous, approach may have to be used [7–9]. The choice of route will be determined by the heart defect itself, the operator's experience, and the type of intervention being used. The jugular venous approach is technically easier to negotiate than the transhepatic approach, but a particular planned intervention may necessitate the use of the latter [7,8].
For left heart catheterization, which may be required, for example, in cases of aortic stenosis or coarctation of the aorta, the options for access include the femoral,

carotid, axillary, or brachial arteries [10]. In some cases, an antegrade approach from the femoral vein may be used for ICC procedures on left heart defects.

Equipment used in ICC procedures

Due to the complex nature of CHD and the ICC techniques performed on them, the equipment used must be tailored to the specific requirements of the defects in question. Therefore, body, heart, and vessel sizes are important considerations. Some ICC procedures undertaken in pediatric patients are such that the devices employed (e.g. stents) need to keep pace with the growth of the patient. In this case, it is important to select stents that can be redilated to an adult size when necessary. In babies, the profile of the balloons used is important in order to minimize potential physical trauma to the

vessels, therefore it is not preferable to use high-profile balloons that are designed for use in adults. Low-profile balloons that are designed for use in babies and children are available, as are devices for closing left-toright shunts (such as atrial and ventricular septal defects [ASDs, VSDs], or patent arterial ducts [PADs]) [11,12].

Objectives of ICC procedures

There are two main objectives of ICC procedures. Firstly, to reduce blood flow through a shunt or to close the shunt altogether. Secondly, to increase or maintain blood flow in a vessel by releasing an obstruction (e.g. to relieve the hemodynamic sequelae of a previous operation via percutaneous valve replacement).

The reduction or closure of cardiac shunts

Porstmann et al. were the first researchers to promote the use of ICC with an Ivalon plug for the closure of a persistent arterial duct [13]. Indeed, they achieved high success rates with this technique, despite the large profile of the device. However, the procedure was complex, requiring the use of a large size sheath and an arteriovenous guidewire circuit. Due to these difficulties the technique was confined to use in adults. Consequently, it appeared as if the number of procedures that could be performed would be limited, which had a negative impact on the interest the technique held for relevant parties and resulted in the development of alternative methods and devices.

The Rashkind arterial duct occluder was used for several years because it could be adopted in older children and adults and produced good results [14]. However, its use involved a relatively complex, technical procedure, and the device was subsequently

superseded by the development of coils and other devices, such as the Amplatzer Duct Occluder (AGA Medical Corp., Golden Valley, MN, USA). For small arterial ducts, controlled-release detachable coils, such as those produced by Cook Inc. (Bloomington, IN, USA), and NitOcclud coils (Produkte für Die Medizin, Cologne, Germany) for small persistent ductus arteriosus (PDA), are used for PDAs, with good results (**Figures 1A** and **1B**). The coils are made from either stainless steel or nitinol.

The use of coils involves a much simpler technique than is used with an Ivalon plug/Rashkind arterial duct occluder, and coils can be delivered through the venous or arterial approach. Depending on the size of the duct, one or more coils may be necessary to achieve complete closure [15]. For larger ducts, the Amplatzer Duct Occluder is used. This is made from nitinol and contains a polyester patch within the meshwork. It is implanted using the femoral venous approach and has a high rate of >95% occlusion [16].

The ideal ASD suited for catheter closure with a device is a centrally located one with rims on all sides. However, in practical terms, more than one-third of ASDs have a deficient or absent aortic rim. It has become apparent that the aortic rim is not essential for the safe deployment of the Amplatzer device, although the presence of an inferior rim is crucial [17].

The procedure for closure is similar for whichever device is used, and involves a femoral venous approach, the positioning of a guidewire in the left upper pulmonary vein, and the placement of a long sheath in the left upper pulmonary vein or the left atrium. Transesophageal or intracardiac echocardiographic guidance is essential (**Figure 2A**) [18]. With any device used, the left atrial disc is deployed within the left atrial cavity, and the device/sheath system

Figure 1. A: Aortogram in lateral projection showing a persistent arterial duct. B: Aortogram in lateral projection showing a persistent arterial duct occluded with a controlled-release detachable coil.

withdrawn as a unit until the left atrial disc is close to, or in contact with, the atrial septum before the right atrial disc is deployed in the right atrium (**Figure 2B**). Once the device is in the correct position, a wiggle maneuver is performed to prove the safe position of the device, and then the release mechanism is activated.

King and Mills first reported the use of an umbrella-type device to close an ASD in 1974 [19]. Further design modifications

resulted in the use of a double-umbrella device, the Rashkind arterial duct occluder, in the 1980s, and additional adjustments led to the manufacture of the Cardioseal and StarFlex (both NMT Medical, Boston, MA, USA) devices in the 1990s [20]. The disadvantage of the Cardioseal and StarFlex products is that they are only suitable for closing defects <20 mm in diameter. For the closure of larger defects, the most common device in use today is the Amplatzer Septal Occluder (AGA Medical Corp.), which is available in many different sizes [21,22]. Larger ASDs of δ36 mm in unstretched diameter can also be closed using the Amplatzer Septal Occluder, although the procedure is much more challenging [23]. Other devices are available for the closure of inter-atrial communications, such as the Helex septal occluder (WL Gore & Associates, Flagstaff, AZ, USA), which is a nitinol spiral with a gortex membrane [24]. This product is suitable for use in defects δ20 mm diameter, multi-fenestrated defects, and patent foramen ovale (PFO). PFO can also be closed using the Cardioseal and Starflex devices. Indications for closing PFO include previous stroke, migraine with aura, orthodeoxia platypnea, and decompression sickness caused by diving [25–27].

The transcatheter approach for closing VSDs was described as early as 1988 [28]. The technique specific to the transcatheter approach for closing VSDs is much more complex than that used for ASDs and invariably requires the use of an arteriovenous guidewire circuit. Creation of this circuit involves crossing the VSD from the left ventricle with a guidewire and snaring it in the main pulmonary artery; the sheath is then introduced from the femoral or jugular vein. After positioning the sheath in the left ventricle, the device is deployed using a method similar to that employed in ASD closure [29,30].

Depending on the location of the VSD, devices can be delivered from either the right internal jugular vein (for apical VSDs and some low muscular VSDs) or the femoral vein (for high muscular or peri-membranous VSDs). The delivery and release mechanisms are the same as those employed for closing ASDs, as are most of the devices used. However, the Amplatzer apparatuses are used the most frequently because they are designed specifically for both muscular and peri-membranous defects (**Figures 3A–C**) [29]. In addition to these devices, controlledrelease NitOcclud coils can be used, specifically in small peri-membranous VSDs that are partly closed by tricuspid tissue [31]; however, occasionally coil migration may

occur and there are rare reports of aortic valve damage [32].

In some patients with a complex CHD consisting of a small hypoplastic right or left ventricle, the only available longterm surgical palliative option is a Fontan operation, which involves directing the superior and inferior vena caval blood directly into the pulmonary arteries. While, in the majority of cases, patients have almost complete oxygen saturation, on occasion the surgeon will leave a fenestration in the systemic atrium. This allows for some right-to-left shunting, potentially reducing

Figure 2. A: The Amplatzer Septal Occluder well visible on transesophageal echocardiography. B: Antero-posterior projection showing an Amplatzer Septal Occluder during the wiggle maneuver.

the incidence of postoperative pleural and pericardial effusions. Sometimes these fenestrations result in unacceptable desaturation and therefore need to be closed, which can be done using any device capable of closing ASDs [33]. In other patients who have undergone the Fontan operation, desaturation may occur through the development of venous collaterals arising from the systemic veins (such as the superior or inferior vena cavae, or the innominate or subclavian veins) draining into the pulmonary veins or the left atrium. Such shunts can be closed using the previously mentioned coils or occlusion devices [34,35].

Relieving obstructions in CHDs

Balloon dilation and catheter valvotomy

One of the first attempts at using ICC for the treatment of a CHD was balloon dilation of the pulmonary valve [36]. A major drawback of the use of this technique in children was the large profile of the balloons involved. The coronary balloons used in adult patients with coronary artery disease (CAD) were too small for use in the pulmonary valves, and the larger balloons employed in the peripheral circulation had too large a profile for safe use in children. A low profile balloon, the Tyshak balloon (B. Braun Medical Inc., Bethlehem, PA, USA), was developed in the early 1990s for use in pediatric cardiology [37]. Since then, several other balloons for children have entered the market. These have a low profile, a variety of lengths and diameters, and some have high rupture pressures [1]. For pulmonary valve dilation, a stiff guidewire is usually positioned across the pulmonary valve and into either the right or the left lower lobe pulmonary artery. A balloon of an appropriate diameter is advanced along this wire and, once in position, is inflated

to the pressure recommended by the manufacturer. The balloon diameter selected is approximately 120% of the diameter of the valve annulus (**Figures 4A** and **4B**). The results of this procedure are encouraging, but pulmonary regurgitation post-procedure may be of some concern in the long-term [38]. Nevertheless, the ballooning of the pulmonary valve is considered to be a curative treatment.

In a more complex CHD, such as membranous pulmonary valve atresia and intact ventricular septum, catheter valvotomy using laser or radiofrequency heat has been successfully performed [39,40]. These

Figure 3. A: Lateral projection of left ventricular angiocardiogram showing a VSD. B: Lateral projection showing an Amplatzer VSD occluder deployed. C: Lateral projection of left ventricular angiocardiogram displaying a VSD occluded by an Amplatzer VSD occluder.
VSD: ventricular septal defect.

Figure 4. A: Lateral projection of right ventricular angiocardiogram showing pulmonary valvar stenosis with thickened valvar leafl ets. B: Lateral projection displaying guidewire and infl ated balloon in position to dilate pulmonary stenosis.

procedures are certainly recommended in newborn babies with a normal-sized right ventricle, yet may also be used in those with only a moderately subnormal right ventricle. The technique involves passing a catheter from the femoral vein to slightly below the pulmonary valve, and from the femoral artery through the arterial duct to just above the pulmonary valve. Once the position and direction of the catheters (especially the venous catheter) are correct, a laser or radiofrequency wire is passed through the venous catheter. Heat is applied to the tip of the wire, as it is gently advanced until it passes into the main pulmonary artery. The wire can then be advanced on its own through the arterial duct into the descending aorta. Opposingly, another 0.014-inch exchange length wire can be passed alongside the catheter guidewire lumen into the main pulmonary artery and caught with a loop snare from the arterial catheter. Once an arteriovenous guidewire circuit is established, a balloon of an appropriate diameter is passed along the wire and ballooning of the pulmonary valve is completed (**Figures 5A–C**). An alternative source of pulmonary blood supply may be needed in babies with small right ventricles. In such patients, either the duct can be stented at the same time as the catheter valvotomy [41], or a systemicto-pulmonary shunt can be performed surgically. The results of catheter pulmonary valvuloplasty are encouraging and compare

well with the surgical approach to this condition [42].

When severe, aortic stenosis in the newborn creates a high-risk CHD. Treatment options include surgical valvotomy or catheter balloon dilation, although any such procedure is palliative. The results of interventional treatment are as good as those for surgery in critical aortic stenosis of the newborn and young infant [43]. Most often, a retrograde approach is used for the balloon dilation. The valve is crossed with a superfloppy guidewire, which is looped in the left ventricular cavity. A low profile balloon is passed along the wire and positioned across the aortic valve (**Figures 6A** and **6B**). Once in position, the balloon needs to be inflated and deflated quickly, since during inflation the left ventricular outflow tract is completely obstructed and the ventricular contraction forcefully ejects the balloon out into the ascending aorta, potentially damaging the

Figure 5. A: Lateral projection of right ventricular angiocardiogram showing pulmonary valvar atresia. B: Lateral projection displaying a stent in the arterial duct after ballooning of the pulmonary valve. C: Lateral projection of right ventricular angiocardiogram showing the forward fl ow through the valve after valvotomy.

Figure 6. A: Antero-posterior projection of left ventricular angiocardiogram showing critical aortic stenosis. B: Antero-posterior projection displaying guidewire and infl ated balloon in position to dilate critical aortic stenosis.

aortic valve. This poses less of a problem in a newborn as the stroke volume is small, but may be a concern in older infants and children. Adenosine has been used to induce temporary asystole while the balloon dilation process is being completed.

Temporary rapid pacing to reduce the intraventricular pressure may help maintain adequate balloon positioning more controllably than adenosine and has been increasingly adopted [44]. The balloon diameter selected for dilation is usually 80–90% of the aortic valve diameter. It is important not to exceed the aortic valve annulus diameter as this will result in severe aortic regurgitation (AR) [45]. Although AR is an important but infrequent complication, the degree of AR is higher and usually of more clinical significance than in the pulmonary valve [43]. In the medium- to long-term, significant AR may be less well tolerated than pulmonary regurgitation. If severe AR occurs immediately after balloon dilation, it may be because the balloon is poorly tolerated and the infant may require much earlier surgical intervention than had been anticipated. There is some evidence that the degree of AR may increase over time in patients who underwent aortovalvuloplasty [46].

Attempts have been made to relieve

infundibular obstruction in patients with tetralogy of Fallot (ToF) by balloon dilation. Interestingly, although the rate of hypoxic spells may be reduced and oxygenation improved, the gradient across the right ventricular outflow tract may not be reduced significantly [47]. This is because the pulmonary blood flow is increased postprocedure. This procedure may have a limited role in the modern management of ToF, whereby early correction is advocated, but balloon dilation may be needed in babies with hypoplastic pulmonary arteries to rehabilitate the affected channels [48].

Stenting

Although balloon dilation has been attempted in all age groups, some narrowed arteries have a tendency towards obstruction recurrence, and this is indeed the case with native pulmonary artery stenosis. In some patients with native and recurrent aortic coarctation, balloon dilation may not adequately relieve the obstruction, while in patients with (usually post-surgical) superior and inferior vena caval obstruction, balloon dilation may only result in short-term relief. In these situations, stents have been employed. Stents were only used in the pediatric population long after they were introduced into adult medicine [49]. For pediatric use, special equipment is required [50]. The ideal stent should not shorten upon expansion to different diameters, should be able to dilate as the patient grows, and should not promote neointimal proliferation [51,52]; it should also be biodegradable. However, no such stents exist for use in children. The most frequently used stents in pediatric practice today are the Palmaz Genesis (Cordis, Warren, NJ, USA) and Cheatham–Platinum stents (NuMED Inc, Hopkinton, NY, USA), both of which foreshorten by approximately 15–20% when dilated to the most common diameters [53]. In children, stents might need to be re-dilated after a few years due to growth of the patient [3,49,52,54].

Stents may be indicated in stenoses of pulmonary arteries (in either one or both proximal pulmonary artery branches, the latter requiring the simultaneous implantation of two stents) [3,49]. Stent implantation involves access from the femoral vein, although occasionally jugular or hepatic venous access is required. Following detailed hemodynamic evaluation, angiography is performed. The maximum diameter of both the stenosis and the branch pulmonary artery on either side of the stenosis are measured. A balloon is selected of a similar size (usually 18–20 mm) to the diameter distal to the stenosis, and a stent capable of being inflated to an adult size (usually a Palmaz Genesis or

Cheatham– Platinum stent) is used. The stent is manually crimped onto a deflated balloon, and a small piece of tubing cut from a sheath is placed over both stent and balloon to protect them during their passage through the diaphragm of the long sheath in the femoral vein. A superstiff guidewire is placed in a distal lower

lobe branch pulmonary artery, and an appropriately sized long sheath (usually a Mullins sheath) is passed over the guidewire and positioned just beyond the stenosis. After removing the dilator from the long sheath, the stent/balloon assembly is passed along the guidewire into the correct location, and the sheath is withdrawn to expose the stent. After check angiography, the balloon is inflated to the required diameter and to the pressure recommended by the manufacturer. Following careful withdrawal of the balloon, angiography and pressure measurements are repeated. If bilateral origin stenoses are present, simultaneous stent implantation is required, in which case stiff exchange length guidewires (i.e. wires long enough to allow for the exchange of the catheters) are placed in both lower branches of the pulmonary arteries. The rationale for simultaneous implantation is to maintain access to both the branch origins, as a stent will usually protrude into the main pulmonary artery, and therefore cause technical difficulties if access is required into the other branch (**Figures 7A–C**).

Although balloon dilation for coarctation of the aorta produces good results in older infants, children, and adults, surgery is superior in neonates and smaller infants [55]. In cases of recoarctation after previous surgery, balloon dilation is successful in relieving this condition in >70% of patients [56]. In teenagers and adults, both native and aortic recoarctation may be better treated with stent implantation as this technique offers more control in dilating the narrow segment. Balloon dilatation with stents is more effective in reducing pressure gradients than balloon dilation alone [57]. In coarctation of the aorta, the stents are implanted retrogradely via the femoral artery. After angiography, accurate measurements of the transverse aortic arch, the narrowest diameter of the coarctation, and the diameter of the aorta at the level of the diaphragm are taken. An Amplatz Super Stiff Guidewire (Boston Scientific, Natick, MA, USA) is placed in the ascending aorta, and an appropriately sized Mullins sheath is inserted and positioned just above the site of coarctation. Available stents for this procedure include the Palmaz

Genesis, Cheatham–Platinum, Intrastent (EV3 Inc., Plymouth, MN, USA), and Jomed (Jomed International AB, Helsingborg, Sweden) stents. The stent is mounted onto a balloon of a similar diameter to the transverse aortic arch, and the stent/balloon assembly is then advanced through the sheath. After check angiography for accurate positioning, the balloon is inflated. If a baremetal stent is used, it is preferable to dilate the stent to approximately 70–80% of the ultimately desired diameter, with a view to dilating it fully after approximately 6 months so as to allow any tears to heal (**Figures 8A** and **8B**) [58]. Nowadays, as a matter of routine, right ventricular rapid temporary pacing is used to reduce the cardiac output and maintain a systolic blood pressure of

Figure 7. A: Antero-posterior projection with cranial angulation of pulmonary arteriogram showing bilateral pulmonary artery stenosis. B: Antero-posterior projection with cranial angulation displaying bilateral stents in place and balloons simultaneously infl ated. C: Antero-posterior projection with cranial angulation of pulmonary arteriogram showing the post-interventional result.

<50 mmHg during the inflation of the balloon in order to minimize the possibility of stent migration [3,59].

More recently, covered stents, such as the Cheatham–Platinum stent, have become available. The use of these stents may help to deal with aortic coarctation associated with a persistent arterial duct or aneurysm [50,60]. However, these devices are increasingly being used as a first-choice treatment in patients with long segment native coarctation, a tortuous aorta, Turner's syndrome, or any dissection or aneurysm that occurs following surgery or balloon dilation.

Valved stents have recently been introduced to replace pulmonary or aortic valves without the need for cardiac surgery [50,61]. Their role in the field of cardiology is currently being evaluated.

Fetal interventions

The equipment used in pediatric ICC is highly specialized, and devices that are flexible yet stable have been developed. The smaller the child, the more specialized the equipment needs to be [1]. Moreover, for fetal intervention, the results of which have been reported by Kohl et al., the equipment required must be smaller and more specialized [62,63]. These researchers have further demonstrated through animal models that intra-uterine aortic valvuloplasty and temporary pacing are possible without open fetal surgery. In addition to earlier attempts at aortic valvuloplasty, other groups have also attempted to perform valvuloplasty in fetuses who have pulmonary atresia with an intact ventricular septum. More recently, fetal atrial septostomy has been performed,

with limited success [64].

Hybrid approaches to CHD

Pediatric cardiac interventions are usually performed in the catheter laboratory. For some CHDs, a hybrid approach combining surgery and catheterization is appropriate [5,6,65], and this practice is now increasing. For example, to maintain the systemic circulation in hypoplastic left hearts, surgeons can perform bilateral pulmonary artery banding while an interventionist may stent the arterial duct; this avoids the need for cardiopulmonary bypass during the first stage of the Norwood operation. At a later date (approximately 6 months later), the pulmonary artery bands are removed, the aortic arch repaired, and a Glenn shunt performed (effectively combining stages I and II of the Norwood operation into a single stage), after which a Fontan operation can be undertaken. Another innovative alternative procedure for the completion of the Fontan circulation in these patients involves the use of surgery for the second stage, but without disconnection of the superior vena cava from the right atrium; a covered stent is then placed between the inferior vena cava and the Glenn shunt, thereby completing the Fontan circulation via a percutaneous technique [5].

Other hybrid approaches include the intraoperative closure of VSDs, in which the surgeon obtains access into the right ventricular cavity with a needle, a guidewire, and then a sheath. The main indications for this are mid or low muscular or apical VSDs, which may prove difficult to access by surgical means. This approach involves closing the defect through a midline sternotomy, without using cardiopulmonary bypass, by deploying a device through the right ventricle [65]. The wire is maneuvered across the defect under echocardiographic guidance. After measurement of the defect, an appropriately sized muscular Amplatzer VSD device (AGA Medical Corp.) is delivered into the left ventricular cavity, positioned across the defect, and released [65].

A similar hybrid approach to intraoperative closure is adopted in the stenting of

Figure 8. A: Lateral projection of aortogram showing native coarctation of the aorta. B: Lateral projection of aortogram displaying a stent in the coarctation.

a branch pulmonary artery, whereby access is obtained through the main pulmonary artery and, under fluoroscopic guidance, angiography is performed and an appropriately sized stent delivered into the pulmonary arteries. Alternatively, if there is easy access to a branch pulmonary artery, a stent can be deployed under direct vision [66].

In all cases, hybrid interventions involve close collaboration between both cardiologist and surgeon, and the procedures can be performed in either an operating theater with fluoroscopy and transesophageal echocardiogram facilities, or in a catheter laboratory with similar equipment available.

Conclusion

Nowadays, ICC for CHD may replace surgery in some cases and complement it in others. In the latter scenario, initial transcatheter palliation might serve to delay surgery until the patient is of an age when the operation can be performed more safely. Occasionally, a hybrid approach may be even more beneficial than ICC first and surgery later, making it imperative that a collaborative approach is adopted in the management of children with CHDs. Newer devices and techniques are continuously being developed, and the indications for their use are becoming wider. Interventions such as valvulo- and angioplasties, closure of PDA, ASDs, and VSDs are now routinely performed in many centers. They can be performed on very young patients, including fetuses.

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Interventional catheterization became the first choice for valvuloplasty, angioplasty and collateral vessel occlusion. Effective and safe transcatheter interventions exist for closure of atrial or ventricular septal defects and for patent ductus arteriosus. The progress in the technology used in the catheterization laboratory will permit to continue the expansion of the range of interventions performed without surgery. Pediatric cardiologists and congenital heart surgeons must understand each other's interventional techniques and how they can be used in a coordinated fashion. This interaction is essential for the optimal management of patients with both simple and complex congenital heart disease. Congenital heart defects are structural abnormalities of the heart present at birth, and that affect blood flow through the heart and to the rest of the body.Â What are the Causes of Congenital Heart Defects? In most cases, no known cause for CHD can be detected. Genetic components like chromosomal abnormalities and single gene defects combined with environmental factors like the motherâ€™s diet could be causative or risk factors involved.Â This procedure can be used to treat any narrowed heart valve. In aortic valve stenosis, the defective valve is the aortic valve. The left ventricle has to work hard to pump the normal amount of blood out to the body plus the surplus blood that gets regurgitated back into the chamber due to the defective valve. Some heart defects, however, are serious and require treatment soon after they're found. Depending on the type of heart defect your child has, doctors treat congenital heart defects with: Procedures using catheterization. Some children and adults now have their congenital heart defects repaired using catheterization techniques, which allow the repair to be done without surgically opening the chest and heart. Catheter procedures can often be used to fix holes or areas of narrowing. In procedures that can be done using catheterization, the doctor inserts a thin tube (catheter) into a leg vein and guides it to the heart with the help of X-ray images. Once the catheter is positioned at the site of the defect, tiny tools are threaded through the catheter to the heart to repair the defect. Congenital heart defects (VPS) are a defective condition that affects various parts of the heart and large vessels close to it, which is determined immediately after birth. Many children with such disorders do not survive, but in some cases surgical treatment can be performed, which allows the child to continue to lead a normal lifestyle. Among children, congenital heart defects are found relatively commonly, in about 1% of the newborns from the total.Â Accurate diagnostics of congenital heart defects is based on the use of instrumental and laboratory methods of research. First of all it is doneÂ Treatment. The main help for patients with congenital heart defects is through surgical intervention. Auxiliary therapy is the use of medication. Medicinal therapy.