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TRANSCATHETER CLOSURE OF PATENT DUCTUS ARTERIOSUS

Thesis

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PLAN

Abbreviations

ADO : Amplatzer Duct Occluder .

COA : Coarctation of the aorta .

CTR : Cardiothoracic ratio .

DAO : Descending aorta

GGVOD : Gianturco-Grifka vascular occlusion device .

KT : Cathétérisme .

LPA : Left pulmonary artery .

LV : Left ventricular .

MPA : Main pulmonary artery .

PAH : Pulmonary arterial hypertension .

PDA : Patent ductus arteriosus .

PVR : Pulmonary vascular resistance .

QP : Pulmonary flow .

QS : Systemic flow .

RV : Right ventricular .

SGA : Small for gestational age .

INTRODUCTION

During the last few years, dramatic changes have taken place in the pediatric cardiac catheterization laboratory.

Improved non invasive diagnostic techniques have narrowed the indications for diagnostic cardiac catheterization, and the laboratory is now increasingly being used for therapeutic procedures. Concern about the appropriateness of some applications of pediatric therapeutic cardiac catheterization has arisen recently because of numerous catheter techniques, the increased numbers of persons and centers using these techniques, and the increased number of lesion types thought to be amenable to catheter therapy.

In comparison with diagnostic cardiac catheterization, therapeutic catheter procedures require more time and resources, are costlier and riskier, and demand more technical training and expertise. High levels of skill are required of the operator who performs the various therapeutic catheterization techniques. These procedures should only be performed in institutions with appropriate facilities, personnel, and programs [1]. These considerations, combined with the rapid increase in the number of laboratories and cardiologists performing therapeutic catheterization procedures, cause concern about hospital and physician credentialing, hospital and physician peer review, and human subjects investigational review. Since publication of the last American Heart Association statement[2] on pediatric therapeutic cardiac catheterization many new devices and applications have been described.

- Objective
  - Report a new technique that is currently developing in unit Pediatric Medical and Surgical Unit - University Hospital Hassan II –Fez.
  - Prove the safety of this intervention that should be a priority rather than a choice.
  - Identify the challenges and limitations of this technique.

PERSONNEL

REQUIREMENTS

Therapeutic catheterization training programs vary in type, extent, and quality. Because of the complexity and potential risks of these procedures, specific credentialing criteria should be developed for those who wish to begin performing therapeutic catheterization as well as for those who continue to perform various procedures.

Performance of therapeutic catheterization in children requires specific training. Pediatric cardiology fellows should receive therapeutic catheterization training in one or more centers that carry out angioplasties, valvuloplasties, and/or vascular occlusion procedures. Before performing a therapeutic catheterization as the primary operator, the fellow or practicing pediatric cardiologist should be required to receive procedure-specific training under the supervision of a qualified individual similar to that required of internist cardiologists who wish to perform coronary angioplasties [3]. Credentialing should be procedure specific. To maintain his or her credentials, the cardiologist should perform or supervise an adequate number of cases annually to maintain skills, and the results must compare favorably with national experience. The cardiologist must be aware of new trends and information through reading and attendance of meetings. However, attending “how-to” seminars and observing experts does not obviate the need for personal experience. An ACC/AHA task force report states that “it is essential that physicians performing angioplasty and related procedures are adequately trained, that facilities and equipment used are capable of obtaining the necessary radiographic information, and that the safety record of the laboratory is acceptable.” [4]

The facility, hospital, quality assurance programs, and laboratory personnel associated with the pediatric therapeutic catheterization program must meet applicable international standards.[1]

FACILITIES

AND EQUIPMENT

A catheterization laboratory in which therapeutic catheterization procedures are performed should be used regularly for all types of congenital cardiac catheterization procedures. The radiographic equipment must be of the highest quality and capable of producing high-resolution images. The equipment must be constantly serviced and regularly replaced or upgraded to maintain the high quality of imaging. Tube angulation systems are necessary. Biplane fluoroscopy/cineangiography must be available in any laboratory in which therapeutic pediatric and congenital cardiac catheterizations are performed. A large and complete inventory of specific equipment is needed. A variety and complete stock of emergency devices such as retrieval catheters are also required.

The institution in which the catheterization laboratory exists must be committed to therapeutic procedures and support of laboratory requirements. The institution must also have a cardiovascular surgical service for immediate treatment of emergencies that may occur during therapeutic catheterization procedures. To maintain proficiency in techniques and to justify the cost of equipment, personnel should regularly and frequently perform specialized therapeutic procedures. A sterile operating room environment must be maintained for many procedures. The sites of implanted devices are exceptionally susceptible to infection.

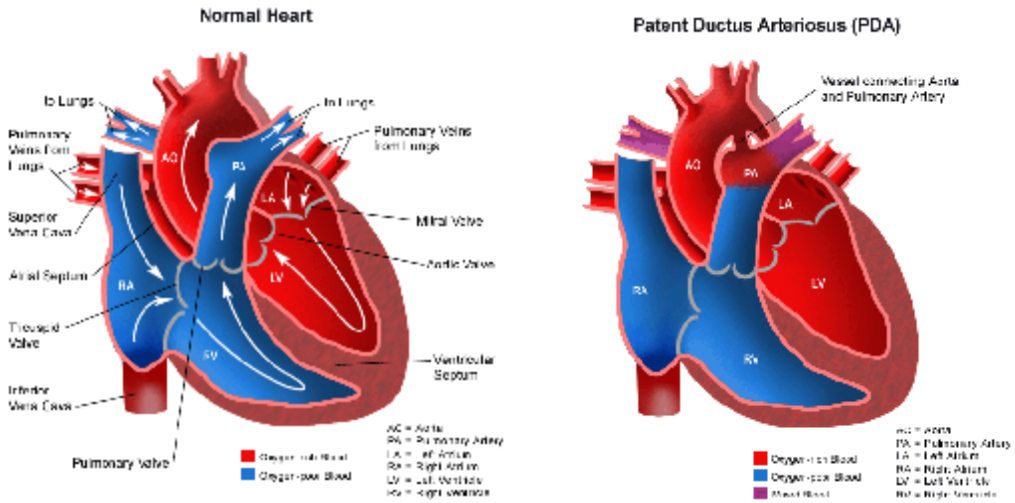
RAPPEL

Patent ductus arteriosus

(PDA), in which there is a persistent communication between the descending thoracic aorta and the pulmonary artery that results from failure of normal physiologic closure of the fetal ductus, is one of the more common congenital heart defects. In full-term children, the reported incidence of PDA is approximately 1 per 2000 live births, accounting for5—10% of all congenital heart diseases. However, addition of the 'silent' PDA dramatically increases its incidence to 1 per 500 live births

The patient presentation of patent ductus arteriosus (PDA) varies widely. Although frequently diagnosed in infants, the discovery of this condition may be delayed until childhood or even adulthood. In isolated patent ductus arteriosus (PDA), signs and symptoms are consistent with left-to-right shunting. The shunt volume is determined by the size of the open communication and the pulmonary vascular resistance (PVR).

Patent ductus arteriosus (PDA) may also exist with other cardiac anomalies, which must be considered at the time of diagnosis. In many cases, the diagnosis and treatment of a patent ductus arteriosus (PDA) is critical for survival in neonates with severe obstructive lesions to either the right or left side of the heart.



INDICATIONS

FOR PERCUTANEOUS

CLOSURE

The procedure is indicated only in patients with continuous murmur suggestive of PDA with Echo-Doppler confirmation. We do not recommend closure of the so-called “silent ductus” detected incidentally without typical auscultatory features[5]. Very small and small PDAs are candidates for closure even though they are not hemodynamiclly significant, mostly to eliminate the risk of sub acute bacterial endocarditis. Medium- and large-sized ducts should be closed to prevent further volume overloading of the left ventricle, to treat Congestive heart failure and to prevent pulmonary vascular obstructive Disease along with eliminating the risk of endocarditis. Closure is Contraindicated in patients with ductal-dependent congenital cardiac anomalies and those associated with pulmonary vascular obstructive disease.

DEVICES FOR PATENT DUCTUS ARTERIOSUS

A number of devices were used in human subjects and underwent clinical trials, but only a few devices are approved by FDA in the US for transcatheter closure of PDA; these include, Gianturco coil, Gianturco- Grifka vascular occlusion device and Amplatzer duct occluder.

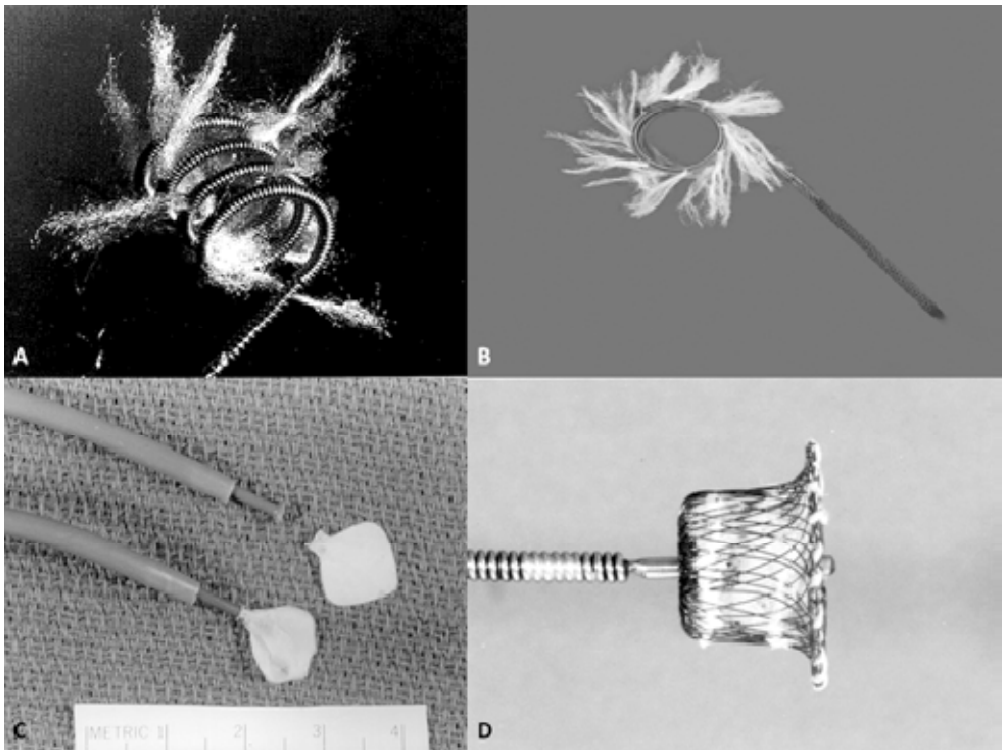


Figure 1: Photographs of transcatheter delivered patent ductus arteriosus occlusion devices:

A. Gianturco coil, B. Cook detachable coil, C: Gianturco- Grifka vascular occlusion device and D. Amplatzer Duct Occluder.

I. Gianturco coils

These are comprised of stainless-steel wire with thrombogenic dacron fibers incorporated into them. These coils were originally described in 1975 [6] and were used to occlude renal arteries and have undergone a number of changes over the years. They are commercially available at the present time for clinical use in a variety of wire diameters, loop diameters and lengths. They were initially used on an off-label basis; subsequently received FDA approval.

Since the initial description by Cambier et al. [7] of occlusion of PDA, a number of refinements and modifications of the procedure or of the coil have occurred; these include ante grade and multiple coil techniques, [8] snare-assisted coil delivery, [9]bioptome-assisted coil delivery, [10]temporary balloon occlusion of the ductus on the aortic [11]or pulmonary artery [12] end, five loop coil design, [13,14] coil delivery via catheters with tapered tip, [15,16] increasing the wire diameter to 0.052˝, [17,18] coil implantation without the use of heparin [19] and detachable design [20,21].

Some of these techniques may have advantage over the conventional retrograde free coil delivery, while others may marginally improve upon the technique. Many of these changes increase the complexity of the procedure, prolong the fluoroscopy and procedure time and add to the cost. These considerations should be taken into account when embarking on the use of modified techniques. Our own view is that conventional retrograde delivery of free 0.038” Gianturco coils for very small PDAs is adequate [22](Figure 1 A).

II. Detachables coils

Gianturco coils have been successfully used in the occlusion of PDA; however, lack of controlled delivery and inability to retrieve and reposition the coil are thought to be potential problems. Consequently, detachable coils have been developed. Two different designs have been undertaken: the first type (Cook detachable coil) has a mechanism in which the notch of the stretched coil winding interlocks with the bead at the end of the core wire in the delivery catheter [20]. Once the coil is positioned appropriately, the coil can be released by the handle at the proximal (outside the patient) end of the delivery catheter. The second design is also a Gianturco coil, but with an added short threaded extension at its proximal end. This is attached to the distal end of the delivery wire, which provides controlled delivery and retrieval when required.

Following implantation at the desired location, the delivery wire is unscrewed from the coil, thus releasing the coil [21]. This is named “Flipper” detachable coil (Figure 1B).

III. Gianturco-Grifka vascular occlusion device (GGVOD)

The GGVOD, consists of a nylon sac and a long occluding wire [23,24] and is presumed to be a modification of Megal’s conical Nylon sack filled with segments of modified guide wire (which was experimented in the late 1980s [25]). The GGVOD is manufactured in several sizes (3, 5, 7, and 9 mm) and can be implanted via 8 French sheaths. It is approved by the FDA for general clinical use. In the limited published studies [23,24] residual shunts were present in 9% patients immediately after device deployment but, all of them closed spontaneously during follow-up. Because of requirement of a large delivery sheath for device delivery and difficulty in retrieval of dislodged devices, it is not commonly used in clinical practice (Figure 1 C).

IV. Amplatzer ductal occluder (ADO)

The ADO is made up of 0.004″ Nitinol wire mesh designed as a mushroom - shaped implant and is self-expandable [26,27]. The device length is 7 mm except for the 5/4 device (which is 6 mm long). The aortic end is 2 mm larger than the pulmonary end, gradually tapers from the aortic to pulmonary end. A thin retention disc is placed at the aortic end and is 4 mm larger than the aortic end of the device.

A recessed screw is assembled into the pulmonary end and is connected to the delivery wire during deployment. Polyester fibers are sewn into the device to encourage thrombosis after implantation. The devices can be implanted via 6 to 8 French sheaths. Multiple sizes are manufactured.

At the present time, ADO is the most commonly used device worldwide in the closure of moderate-to-large PDAs (Figure 1 D).

PRECATHETERIZATION

CARE

The clinical examination demonstrates the PDA continuous murmur in the expected location. The electrocardiogram is often normal. Active infection is ruled out. Transthoracic echocardiography aims to identify any potential associated lesions, to assess left ventricular volume diameters and function, to assess PDA size and, finally, to assess pulmonary arterial pressure. The echocardiogram is very useful in determining if PDA closure is, in fact, indicated. Although it was previously believed that all PDAs identified should be closed, with more relaxed recommendations regarding sub acute bacterial endocarditis prophylaxis in the setting of the ductus, small haemodynamically-insignificant PDAs with no evidence for left atrial or left ventricular enlargement are often not closed.

METHODS

OF DEVICE

IMPLANTATION

The methods of implantation of the two most commonly used devices, namely free Gianturco coils and Amplatzer duct occluder will be described.

I. Angiographical classification

Following a brief assessment of the haemodynamics, PDA closure always begins with an aortogram to precisely assess the aortic arch and PDA characteristics, as the ductus arteriosus may persist in a wide variety of sizes and configurations (Fig. 2). Krichenko et al. described a useful angiographical classification for guidance of transcatheter PDA closure [28].

Ductal anatomy in the lateral projection is classified into five categories:

Type A is a conical ductus, with a well-defined aortic ampulla and constriction at its pulmonary end;

Type B is a large and very short ductus, mimicking an aortopulmonary window-like structure;

Type C is a tubular duct, of varying length, without any constriction at its pulmonary end;

Type D is more complex, with multiple constrictions on the ductus;

Type E is an elongated ductus, frequently seen in ex-premature babies.

This initial angiography is performed with a 4 F or 5 F pigtail catheter positioned in the proximal descending aorta in the straight lateral view. Other projections may be helpful, such as 30° right anterior oblique projections in the left-sided aortic arch, 30° left anterior oblique projections in the right-sided aortic arch and, eventually, a combined left anterior oblique 30°, cranial 30° to open up the pulmonary artery bifurcation and show the proximal left pulmonary artery (for dextrocardia, it is the right anterior oblique equivalent).

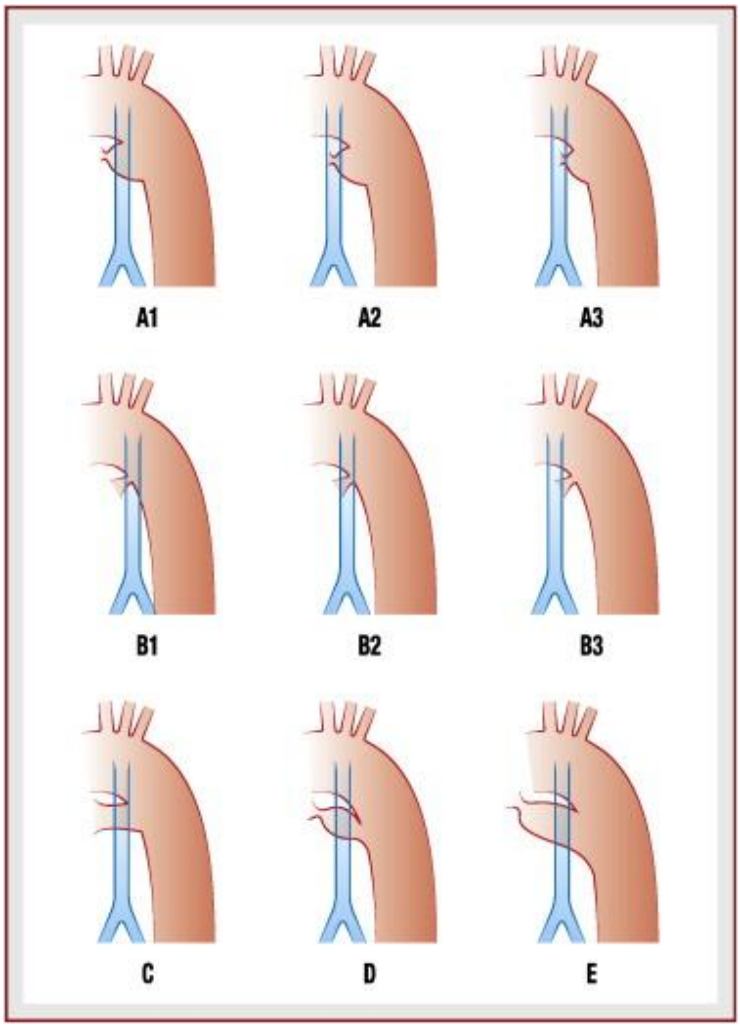


Figure 2.Angiographical classification from Krichenko et al. [28]. Ductal anatomy in the lateral projection is classified into five categories

II. Gianturco coils

Implantation of free coils was initially described by Cambier et al. [7]and the method that we use [5,13, 14, 22] is similar to that detailed by Cambier. Cardiac catheterization is performed percutaneously via the femoral vein and artery to confirm the clinical and echocardiographic diagnosis. Heparin (50 to 75 units/kg) is administered intravenously following insertion of the arterial sheath. Aortic arch angiography in 30° right anterior oblique (RAO) and straight lateral views is performed by injecting 1 ml/kg of contrast material via a 4- or 5-French marker pigtail catheter introduced through the femoral arterial sheath (Figure 3).

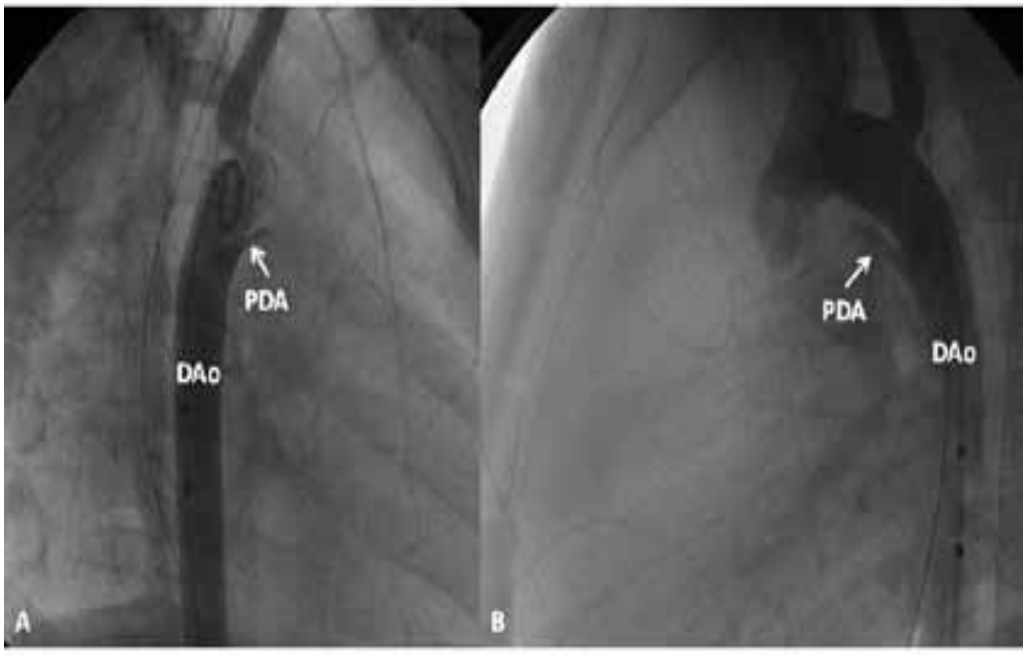


Figure 3: Selected cine frames from aortic arch angiogram in right anterior oblique (A) and lateral (B) views demonstrating a small patent ductus arteriosus (PDA). Catheter with markers is seen in both A & B. DAo, descending aorta.

Measurement of narrowest ductal diameter (usually at the pulmonary end), size of ampulla (at the aortic end) and length of ductus are measured (Figure 4) in both views and averaged.

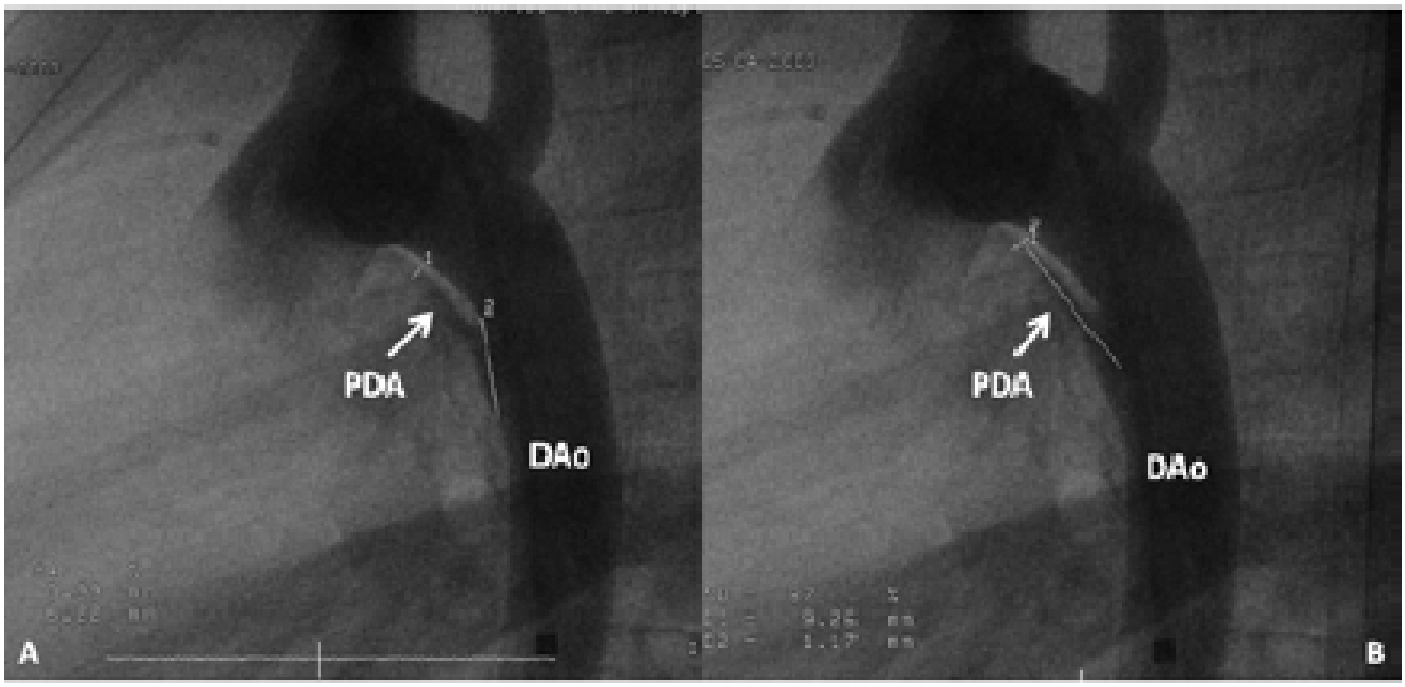


Figure 4: Selected cine frames from aortic arch angiogram in lateral views demonstrating measurements in a patient with small patent ductus arteriosus (PDA). Measurements of minimal ductal diameter and ductal ampulla in A and minimal ductal diameter and length of the ductus in B are shown. Catheter with markers is partly seen both A & B. DAo, descending aorta.

Sometimes foreshortening may give spurious values, which may be ignored. These measurements serve as a guide for selection of the diameter of the coil used for occlusion. We almost exclusively use 0.038" Gianturco coils because of better occlusion when compared 0.035" coils.

A 4-French right coronary artery catheter (Cordis, Miami, FL) or a 4-French Glidecath catheter (Meditech, Watertown, MA) is introduced from the descending aorta into the main pulmonary artery via the PDA.

If the catheter cannot be advanced easily into the ductus, the soft end of a 0.035” straight Benston (Cordis, Miami, FL), straight Teflon-coated Amplatz (Cook, Bloomington, IL), or angled floppy (Meditech, Watertown, MA) guide wire is used to cross the ductus.

Our first preference is straight Benston guide wire.

The catheter is advanced across the ductus over the guide wire. Position of the tip of the catheter in the main pulmonary artery is ensured by pressure measurements and if necessary, test injection of contrast material.

Aortic arch angiographic frames, obtained in the RAO and straight lateral views (Figure 3), are used as a reference/guide throughout the procedure. The relationship of the minimal ductal diameter with the anterior tracheal shadow is noted and should be used to position the coil in the ductal structure.

A coil with a loop 2 to 3 times the narrowest ductal diameter is selected for implantation. The coil is loaded into the catheter with the stiff end of a 0.038-in Teflon-coated guide wire but is advanced with its floppy end. Under fluoroscopic guidance (lateral view) one to one and one-half loops of the coil are delivered into the main pulmonary artery.

The delivery guide wire is partially withdrawn and the entire system (the coil and catheter) is pulled back so that the delivered coil loops are drawn into the pulmonary end of the ductus. Then, the delivery catheter is pulled back gently into the aortic end of the ductal ampulla.

The delivery guide wire is re-advanced until it touches the coil in the catheter. The guide wire is fixed in position and the catheter is slowly withdrawn over the wire into the descending aorta, thus extruding the remaining coil into the aortic end of the ductal ampulla. Thus, the delivered coil straddles the narrowest diameter of the ductus.

Fifteen minutes after coil delivery, repeat aortic arch angiography (Figure 5),

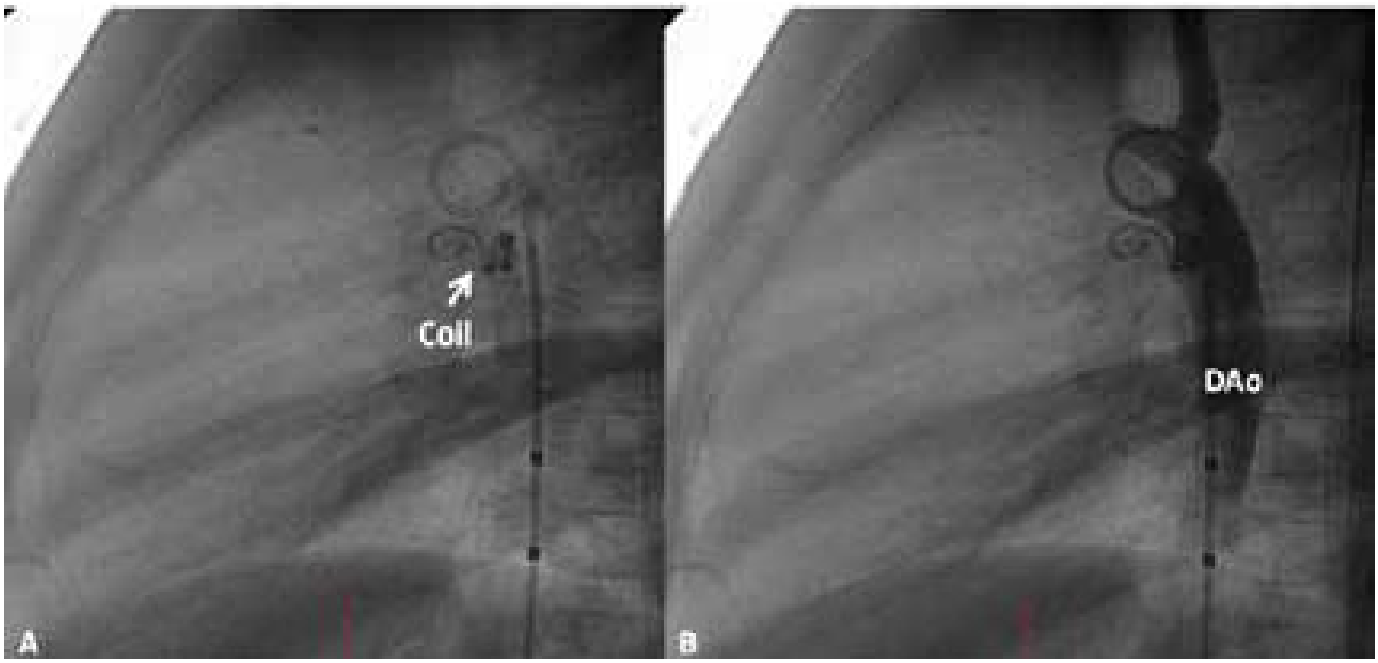


Figure 5: Selected cine frames from aortic arch angiogram in lateral view demonstrating the position of the coil (arrow) in the patent ductus arteriosus (A) and complete occlusion of the ductus (B). Catheter with markers is seen in both A & B. DAo, descending aorta.

Careful pressure pullback from the aortic arch to descending aorta, and measurement of oxygen saturations from the right ventricle, main pulmonary artery and ascending aorta are performed.

One dose of Ancef (25 mg/kg/dose) is administered intravenously in the catheterization laboratory and two additional doses are given 6 and 12 hours after the first dose. The heparin is not continued nor its effect reversed. Clinical evaluation, chest roentgenogram and echo-Doppler studies are obtained on the day following the procedure and at 1, 6, 12, 36 and 60 months after coil implantation.

III. Amplatzer ductal occlude (ADO)

Musura and his associates [27] were the first to report use of the Amplatzer duct occluder in human subjects and the method that we use is similar to that described by Musura. The procedure is similar to that described in the coil implantation section above up to the measurement of ductal size (Figure 6).

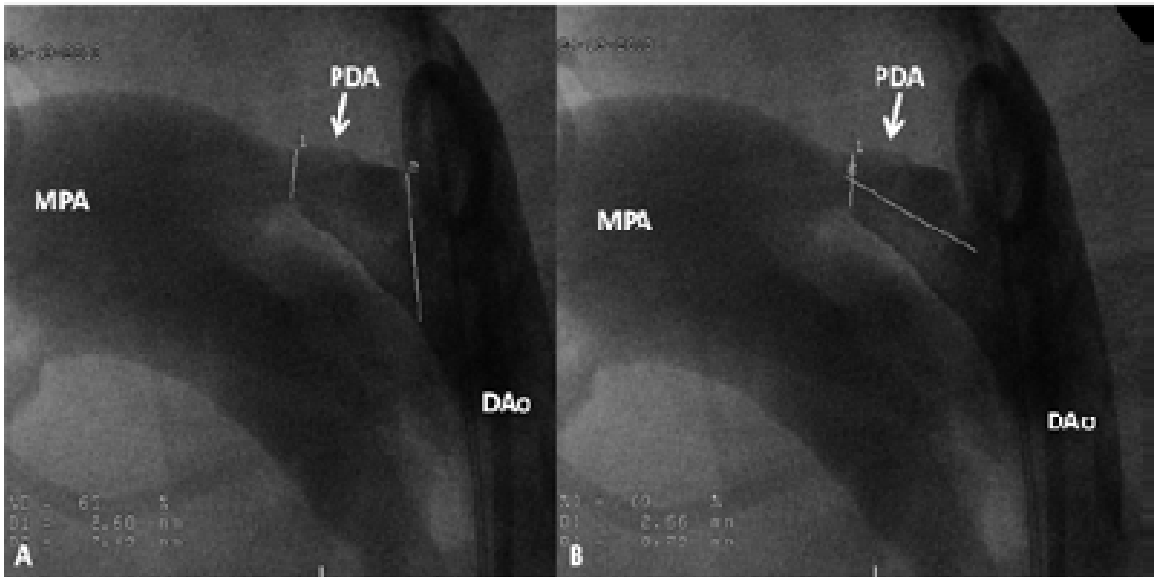


Figure 6: Selected cine frames from aortic arch angiogram in lateral views demonstrating measurements in a patient with moderate to large patent ductus arteriosus (PDA). Measurements of minimal ductal diameter and ductal ampulla in A and minimal ductal diameter and length of the ductus in B are shown. DAo, descending aorta; MPA, main pulmonary artery.

A 4 or 5-French multipurpose catheter is introduced into femoral vein, positioned in the main pulmonary artery and advanced into the descending aorta via the ductus. If the catheter cannot be advanced across the ductus by itself, we use 0.035" straight

Benston guide wire, with a long floppy tip to cross the ductus. A 0.035" extra-stiff exchange-length J-tipped Amplatzer guide wire is positioned in the descending

aorta and the multipurpose catheter removed. In rare occasions when antegrade entry into the PDA is not feasible, a guide wire (exchange length) is advanced into the pulmonary artery via a catheter and introduced into the ductus from the descending aorta.

The guide wire is further manipulated into the right ventricle, right atrium and superior vena cava. The wire is snared from the superior vena cava (or pulmonary artery) and exteriorized via the femoral venous sheath.

Then, an appropriate-sized Amplatzer PDA device delivery sheath is advanced over the wire, across the right heart and ductus and its tip positioned in the descending aorta.

An ADO device whose pulmonary end is 1 to 2 mm larger than the size of the narrowest diameter of the PDA is selected for implantation.

The selected Amplatzer duct occluder is deaerated and screwed onto the delivery cable. After completely screwing the device, the device is unscrewed by one to one and one-half turns to facilitate unscrewing and release after it is positioned in the ductus. The device is withdrawn under saline into the loader sheath and the device is deposited into the delivery sheath already in place while flushing the device loader to avoid air entry into the system.

The device is advanced within the sheath under fluoroscopic guidance. When the tip of the device arrives at the tip of the sheath, the entire system is withdrawn until the tip of the sheath is in the descending aorta just distal to the aortic ampulla of theductus.

Then, holding the device in place, the sheath is retracted so as to uncover and deploy the aortic disc of the device. The entire system is slowly pulled back into the ductal ampulla and if possible into the mid-ductus. An aortogram is performed to evaluate the position of the aortic disc of the device (Figure 7A).

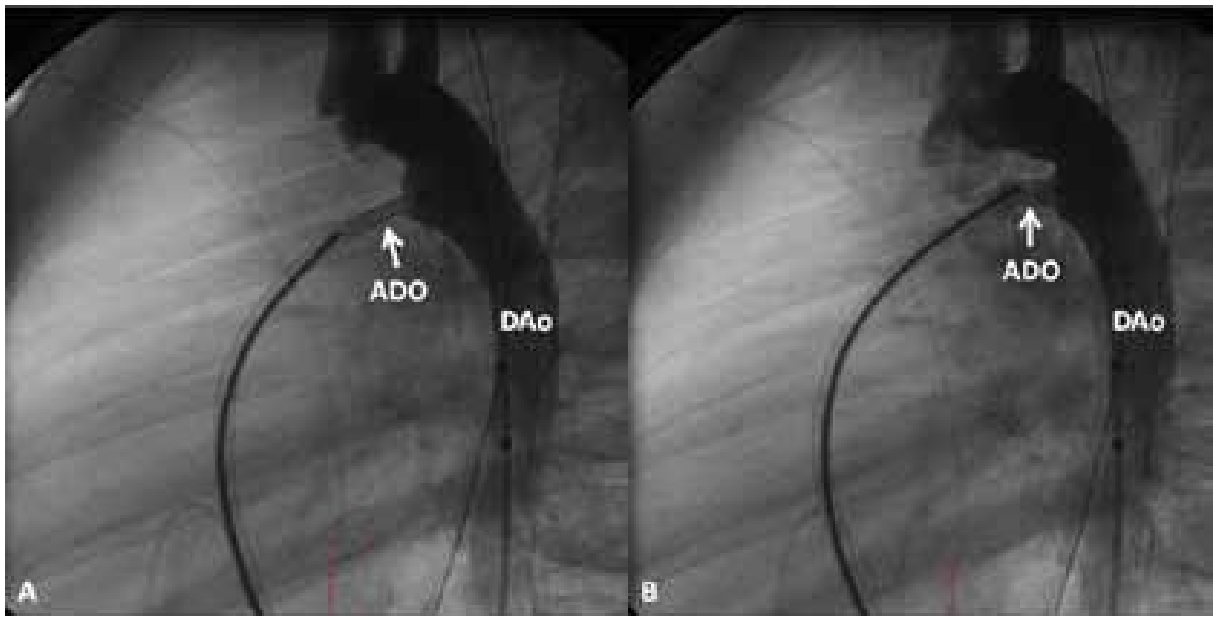


Figure 7:Selected cine frame from aortic arch angiogram in lateral view demonstrating the position of the aortic disc of the Amplatzer duct occlude (ADO) (arrow) in the patent ductus arteriosus (A). Similar cine frame after opening the pulmonary end of the ADO (B). Both illustrate good position of the device components. In B, note small residual shunt thru' the device and none parallel to it. This would indicate that the size of the device implanted is appropriate to the size of the ductus. Catheter with markers is seen in both A & B. DAo, descending aorta.

If satisfactory, the sheath is further withdrawn, while holding the device in place, to uncover the remaining part of the device, across the narrow pulmonary end of the ductus.

An aortogram(Figure 7B) is repeated to verify the position of the aortic disk within the ductus without protruding into the descending aorta and the position of the pulmonary end of the device across the narrowest part of the ductus and that there is no residual shunt around (and parallel to) the device. Having been assured of good position of the device, the delivery cable is rotated counterclockwise until

the device is released thus implanting the device. The delivery cable and sheath are withdrawn into the inferior vena cava and the delivery cable is then taken out of the patient and the delivery sheath flushed.

The long sheath is exchanged with a short sheath. Ten minutes following device implantation, aortic arch cineangiography is performed in 30° RAO and straight lateral (Figure 8) projections.

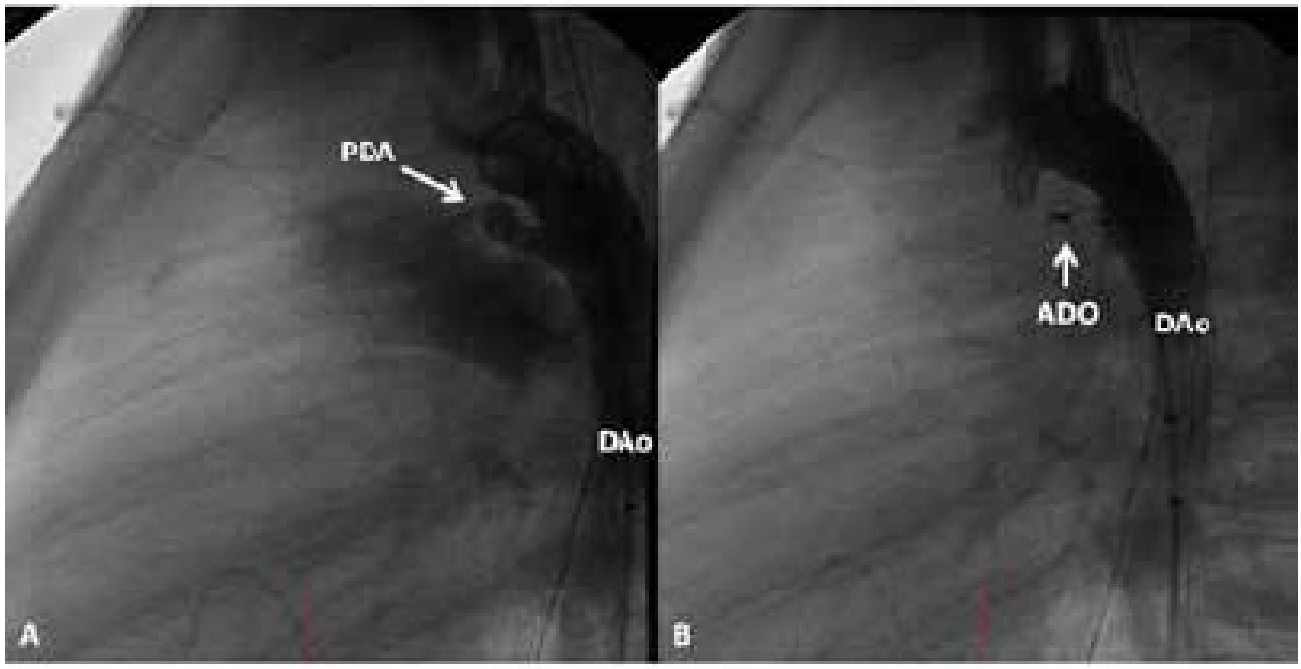


Figure 8:Selected cine frames from aortic arch angiogram in lateral view demonstrating patent ductus arteriosus (PDA) in A. Following implantation and release of the Amplatzer duct occluder (ADO) (arrow), the device position looks good the small residual shunt thru' the device (Figure 7B) is no longer seen (B). Catheter with markers is seen in both A & B. DAo, descending aorta.

Measurement of the pressures on pullback across the descending aorta and right ventricular, pulmonary arterial and aortic oxygen saturations are obtained.

Antibiotic administration and follow-up are similar to those described for the coil occlusion section.

Ø Advantages of Using the ADO for Closing a Large PDA in Infants

The ADO, developed to close moderate-to-large-sized PDA, has a high success rate and low complication rate.[29] [33] They previously proposed a strategic approach to the closure of the ductus: use coils for small-size PDA and the ADO for moderate-to-large ones. There are many reports regarding closure of the ductus using the ADO, but the majority of patients included were over 1 year of age, and reports of ductal closure using the ADO in infants are few and the case numbers rather limited.[30] [31]PDA may be an isolated anomaly or associated with some other cardiovascular anomalies. Infants with a large ductus are usually symptomatic with tachypnea, tachycardia and difficulty in feeding. Failure to thrive and recurrent respiratory tract infections are also quite common. Early closure is generally required to relieve the symptoms. Although coil closure is effective, procedural failure is not uncommon in infants with a large ductus, and using large and multiple coils in infants frequently results in left pulmonary artery stenosis.

Meanwhile, residual shunt is more common in infants undergoing closure with coils than with the ADO. The mean fluoroscopic and procedural times are shorter with ADO closure than with coil closure for large ductus, so the ADO seems to be the ideal device to use in infants with a moderate-to-large PDA. However, difficulties in the deployment of the ADO in young children have been reported[30][31][32] ; for example, kinking of the sheath may occur while advancing the device to the right ventricular outflow tract, although this can be solved by snaring the sheath from the descending aorta[30] or using an Amplatzer vascular plug pushing cable. Left pulmonary artery stenosis is not uncommon following deployment of ADO, but is usually mild (Vmax<2.5 m/ s).

[29] [33] Avoiding using an excessively over-sized device in infants may decrease the incidence of this complication. Coarctation of the aorta following

implantation of an ADO is not rare, but occurs mostly in young infant, in whom an excessively oversized device is implanted, resulting in protrusion of the retention flange into the aorta. An angled device can be useful in infants with a relatively short ductus to minimize protrusion of the upper part of the retention flange. [34] Recently, a swivel-disk device has been developed to diminish the possibility of developing a pressure gradient in the aorta.

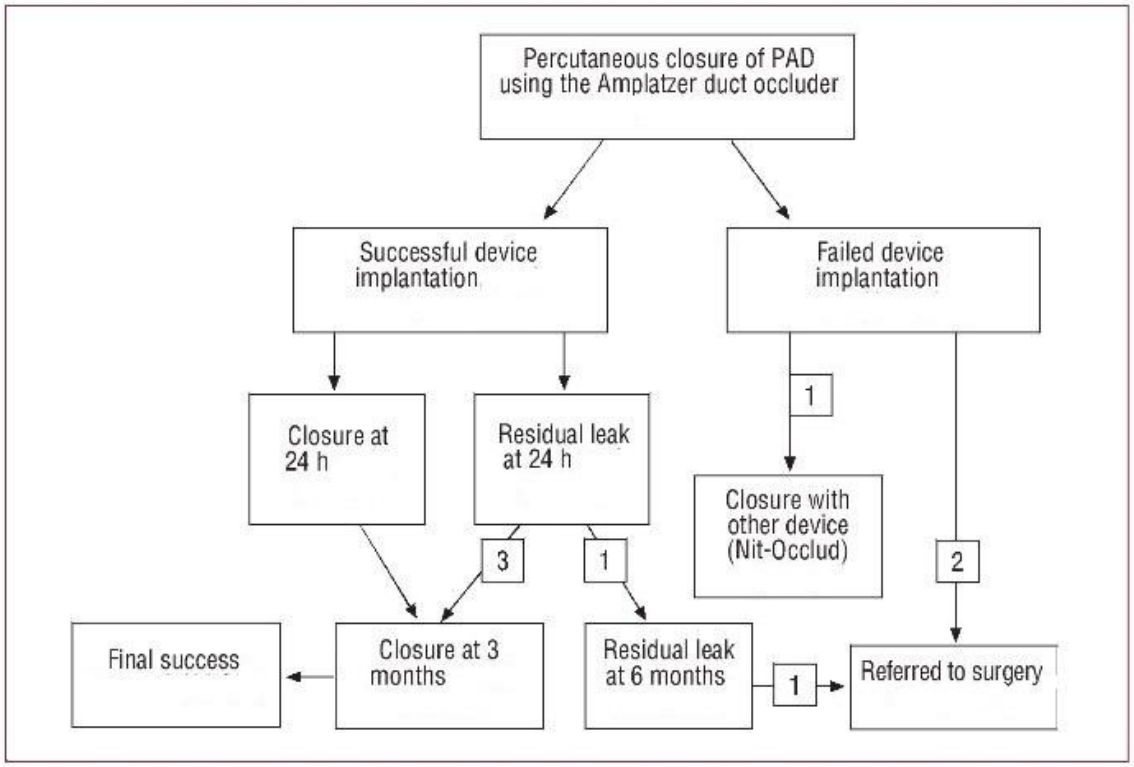
POST

CATHETERIZATION CARE

The patient can be sent home 6-8 hours after the procedure once recovery from sedation or anesthesia is complete especially if arterial access has not been used.[35] For children in whom arterial access was obtained we choose to keep them overnight,

Chest radiography and transthoracic echocardiography were conducted 24 h after the procedure to evaluate the shape and position of the device. Patients had follow up in the Pediatric Cardiology unit at intervals of 24 h then at 1 month, 6 months, and 12 months after the procedure. Patients were checked clinically for any evidence of cardiac murmur during each follow-up. Complete echocardiographic data (left pulmonary artery and aortic Doppler interrogation) in addition to evaluation for residual shunting.

Antibiotic prophylaxis for endocarditis be maintained after the procedure.



COMPLICATIONS

I. Embolization to the Branch Pulmonary Arteries (Fig.9)

This can happen soon after coil release or rarely within 24 hours or exceptionally after that. The dislodged coils usually embolize to the proximal right or left pulmonary arteries if they are large and if multiple coils are used. Single coils usually embolize distally to smaller branches. Sufficient time is available for planned retrieval because instability is rare. The long sheath should be retained in the MPA. A 4 French multipurpose catheter or the 4F snare catheter should be passed via the long sheath and positioned near the embolized coil mass with the help of a glide wire guided by the movement of the coil when it comes in contact with the wire. An Amplatz gooseneck snare (5 mm for children and small vessel embolization, 10 mm for other situations) should be used to grasp the coil tip. When multiple coils have been used for PDA closure it is important to hold the coils at the sutured end. The coils must be captured into the long sheath in the pulmonary artery because it is important to prevent the coil mass to be entangled in the tricuspid valve tensor apparatus

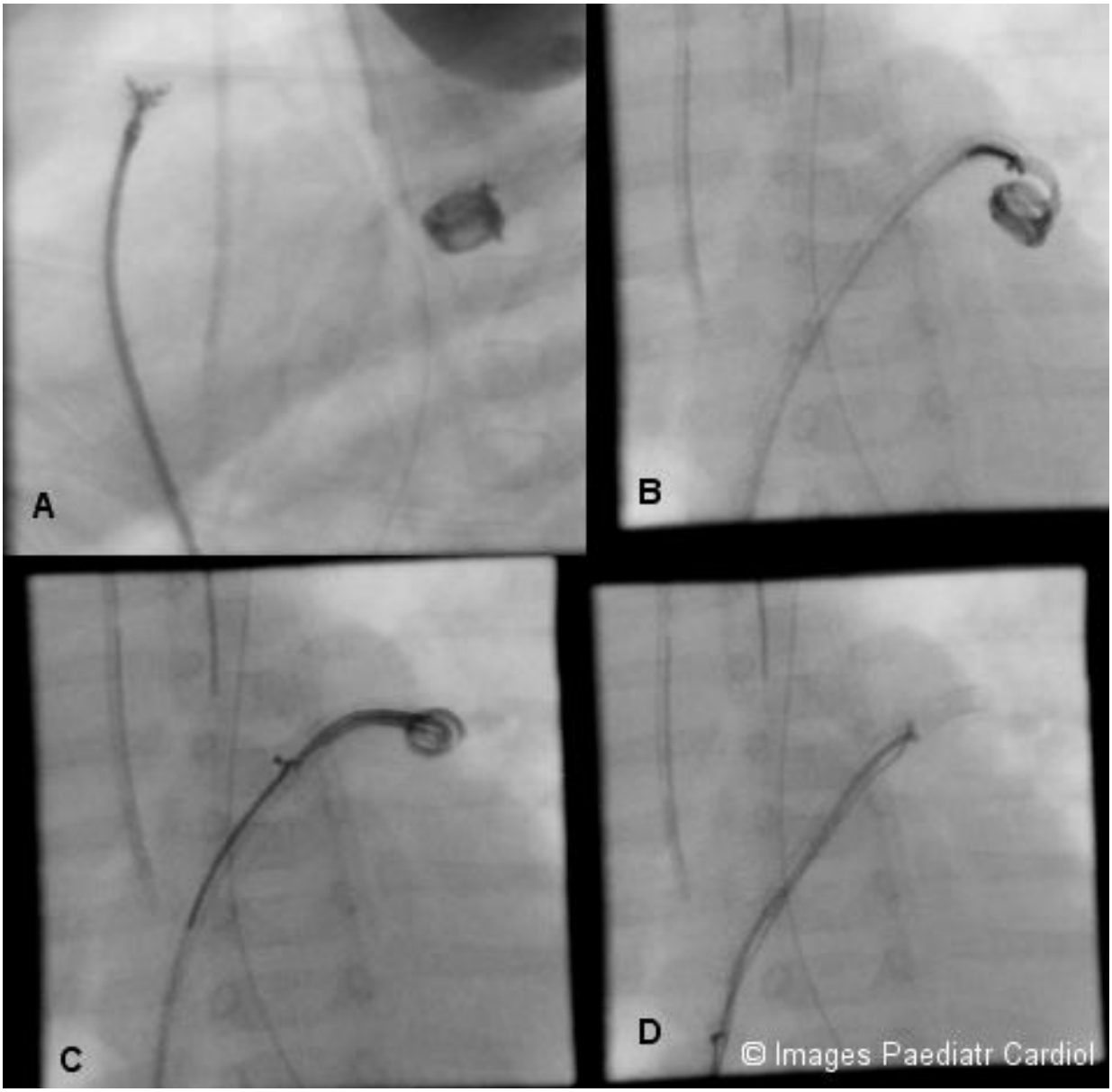


Figure.9 Retrieval sequence after embolization into the left pulmonary artery. Two coils were used to close a large duct an infant. These coils embolized as soon as the jaws of the bioptome were opened into the LPA (A). The sutured end of the coils have been grasped by a snare (B) and withdrawn into a long sheath in the proximal left pulmonary artery (C and D).

II. Embolization to the descending thoracic aorta (Fig. 10)

When coil(s) embolize into the aorta, the duct should be immediately re-crossed with a 5F multipurpose catheter or snare catheter. A 10 mm Amplatz gooseneck snare (Microvena, MN, USA) should be used to hold the end of the coil(s) and the same coil(s) can deployed in the duct once again as the catheter is pulled back towards the MPA.

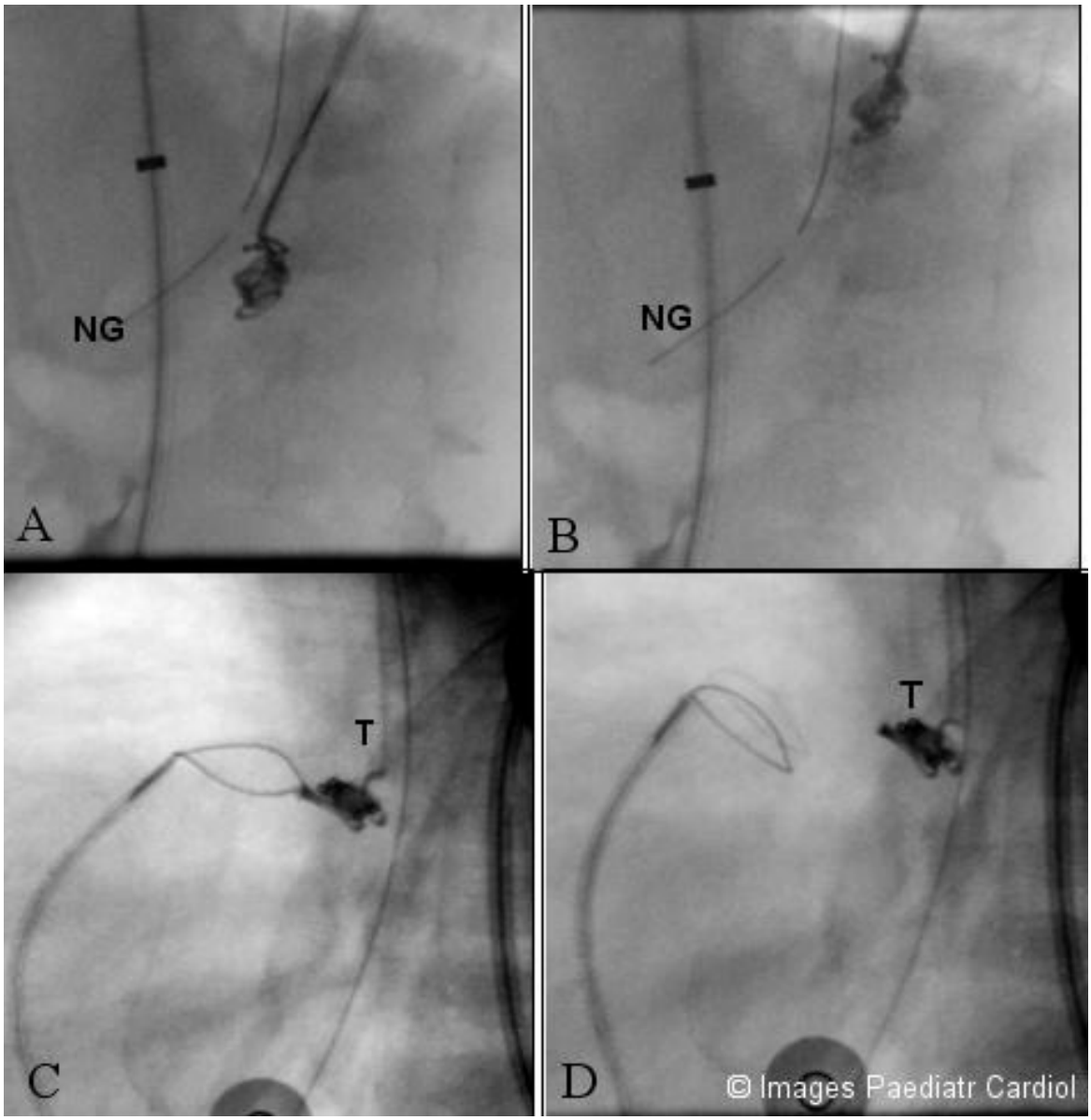


Figure .10 Retrieval sequence after embolization into the descending aorta. The snare catheter is introduced via the femoral vein and advanced into the descending aorta via the duct. The sutured end of the coil is grasped by the snare (A) and withdrawn (B) until the coil mass is firmly anchored in the duct ampulla (C). The snare is released after ensuring a secure position (D). NG: Naso-gastric Tube, T: tracheal air shadow

III. Loss of grip on the coil mass

The jaws of the bioptome may sometimes lose their grip on the coil mass when coils are being pulled back into the long sheath after an initial unsatisfactory deployment. A variable part of the coil remains in the sheath. Attempts to recapture the coils with the bioptome or a snare are unlikely to succeed and the coils may get pushed out of the sheath. A 3 F vascular retrieval forceps (Cook) works well in this situation. The tip of the vascular retrieval forceps has a short (3 cm), soft guide wire that can be positioned adjacent to the coil tip in the sheath. The jaws of the forceps open adequately enough to grasp the coil tip and retrieve the coil mass.

IV. Inability to release the coil after bioptome jaws are opened

Occasionally coil tip remains in the jaws after they are opened. The coils can be released by slow rotation the bioptome with the jaws open. Alternatively, advancing the long sheath to the jaws of the bioptome helps in the release of the coil.

V. Hemolysis from residual flows

Hemolysis is a rare but a serious complication of coil occlusion.[35][36] for hemolysis to occur there often has to be clearly defined residual flow at the end of the procedure together with an audible murmur.

The occurrence of hemolysis correlated significantly with both age as well as duct size.

VI. Infective endocarditis .

PATIENTS AND METHODS

I. Patients and Inclusion / Exclusion criteria

This retrospective study was carried out in Pediatric Medical and

Surgical Unit - University Hospital Hassan II -Fez , from October 2013 to July 2016, during which 25 patients who underwent cardia catheterization in an attempt to close the PDA by transcatheter approach using amplatzer duct occluder device.

The patients were diagnosed to have persistent patency of ductus arteriosus (PDA) based on evaluation with a physical examination, CXR and transthoracic Echo/Doppler study were planned to undergo cardiac catheterization to close the PDA by transcatheter occluder device.

General exclusion criteria include pelvic vein or inferior vena cava thrombosis, sepsis (local and generalized), any type of serious infection less than one month prior to procedure, and demonstrated intracardiac thrombi on echocardiography.

II. The parameters studied

1. Study of epidemiological data

a. age
b. sex
c. weight
d. Personal history

2. Diagnosis

2.1. clinic

a. functional signs
b. physical examination

2.2. Radiography

a. chest X-rays data
b. transthoracic Echo/Doppler data

3. Treatment, Evolution and Post-operative care

III. Difficulties of the study

Like any retrospective study, the major difficulties we encountered were related to the study of records. Some records are incomplete; in these cases it was based on the register of echocardiography to complete the missing data on clinical information and evolution.

RESULTS

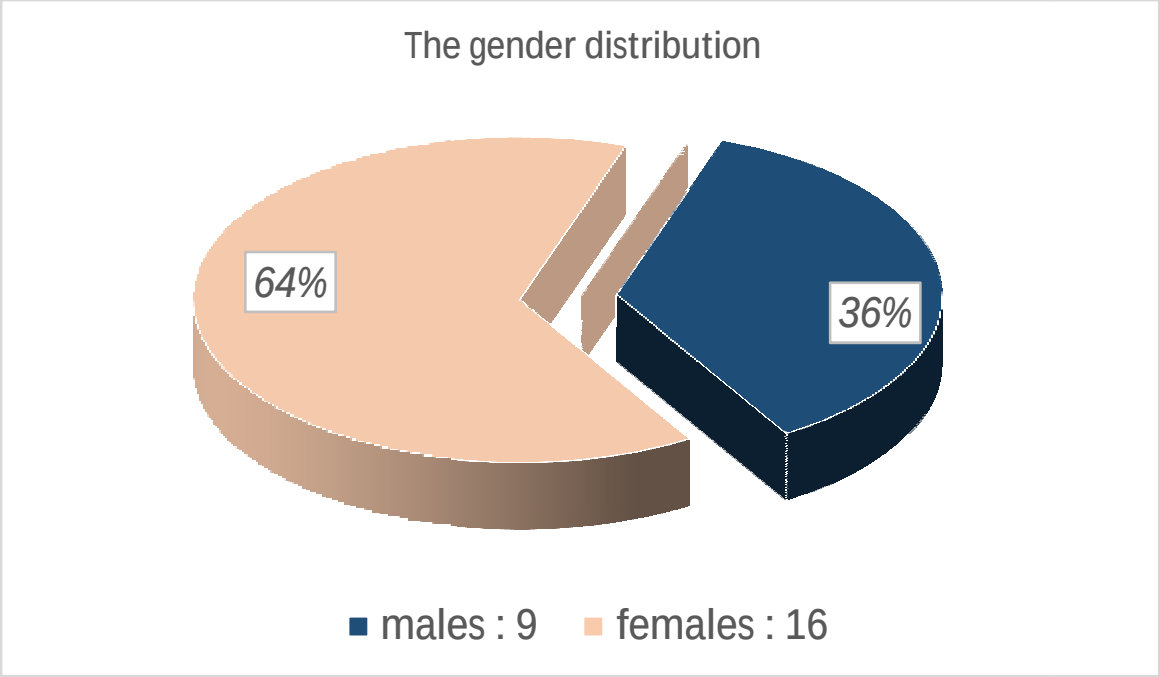
1. Study of epidemiological data

a. Age distribution

We analyzed the medical records of 25 patients , The patients were aged between 1year and 15 years (mean age 6.6 year)

b. Gender distribution

Of the patients, 16 (64%) were females and 9 (36%) were males, sex ratio M / F 0.56 distribution



c. Distribution by weight

The patients were weighed between 7 kg and 45 kg, and their mean weight was 19.4 kg.

d. Genetic syndromes

Five patients had Down syndrome

e. Intracardiac disease and PDA

Patent ductusarteriosus presented as an isolated lesion in 21 (84%) patients.

PDA-associated heart lesions were as follows: 2 cases of interventricular communication, 2 cases of pulmonary stenosis.

f. Etiological factors

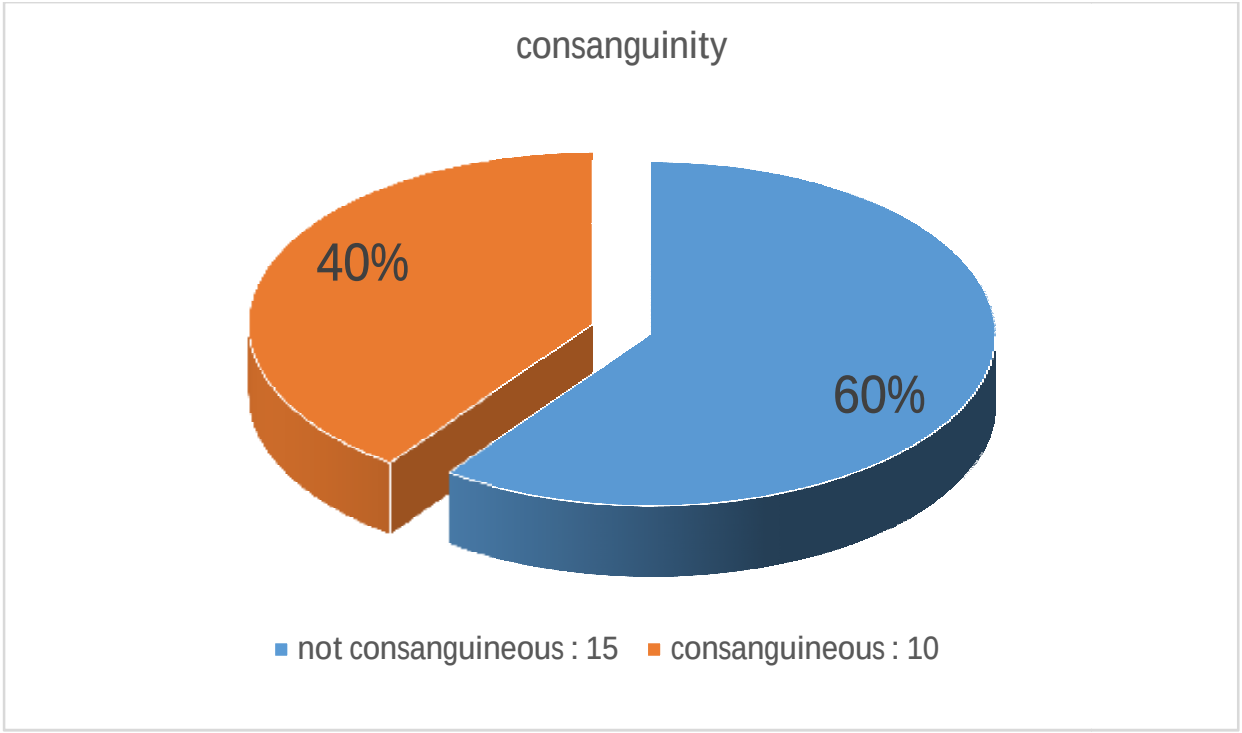
Consanguinity

The notion of parental consanguinity is noted in 10 patients or 40% of cases.

Of these:

7 cases have inbreeding 1st degree

3 cases have a second degree of consanguinity.



Personal history

Table 1: Pathological Personal history

Personal history	Number of cases
Down syndrome (Trisomy 21)	5
rheumatic fever	2
SGA at birth (Small for gestational age)	2
congenital rubella syndrome	1
Hypothyroidism	1

2.Diagnosis

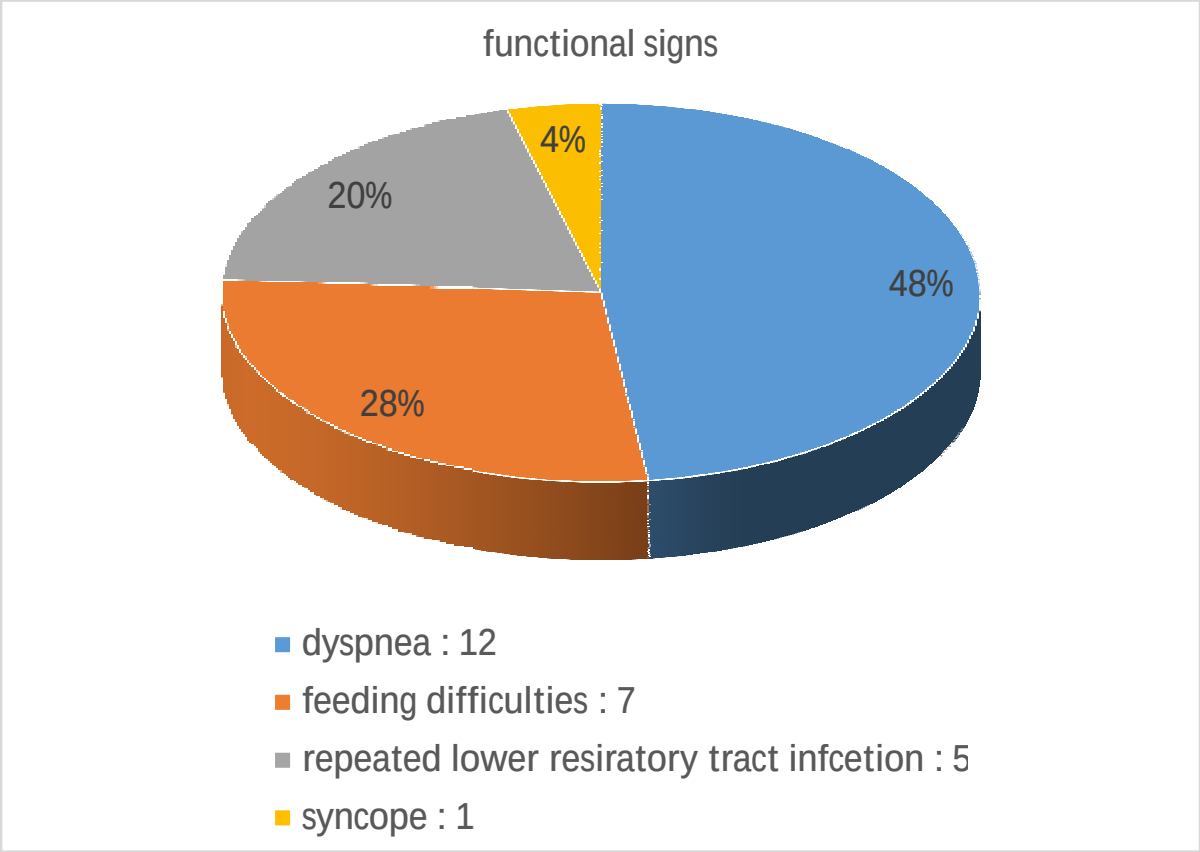
2.1. clinic

2.1.1. functional signs

The clinical symptoms in reported cases in our study are very variable, dominated by dyspnea, feeding difficulties, and repeated lower respiratory tract infections.

Table 2: Distribution of cases according to functional signs

Functional sign	Number of cases	Percentage
dyspnea	12	48 %
feeding difficulties	7	28 %
repeated lower respiratory tract infections	5	20 %
Syncope	1	4 %



2.1.2 cardiovascular examination

a. Pulse Examination;

The pulse is present and symmetrical in 25 patients; representing 100% of the cases have been studied.

b. Blood pressure:

No patient of our cases has a pressure gradient between upper and lower extremities.

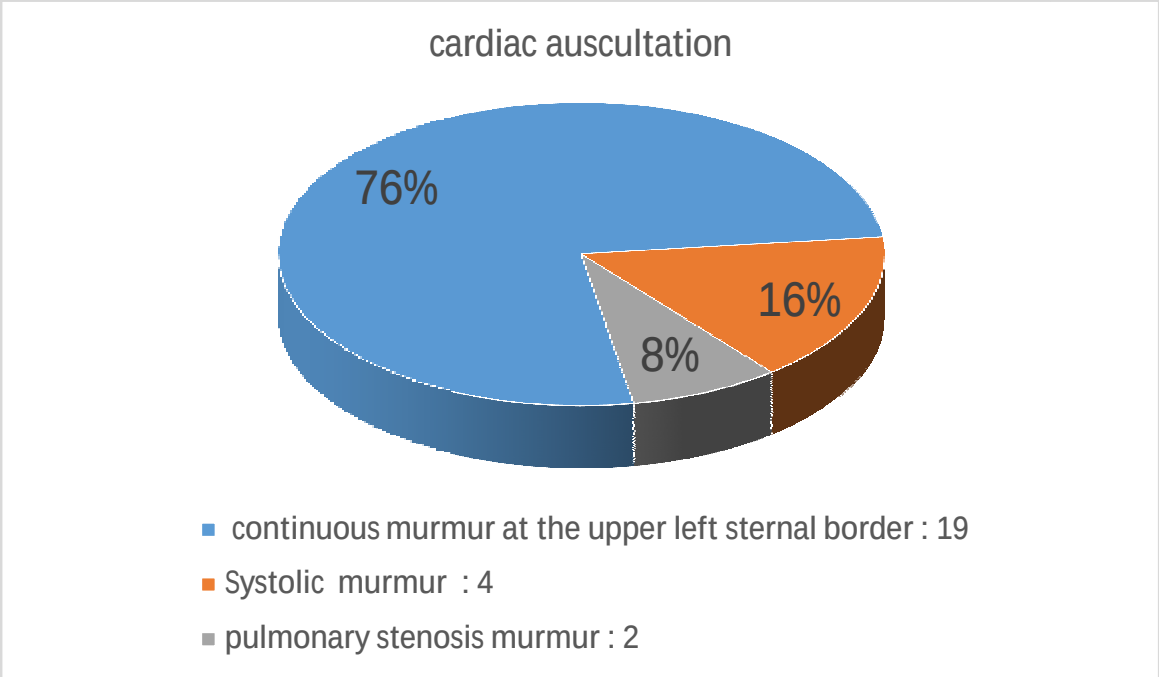
c. Cardiac auscultation

A heart murmur was found in 25 cases, representing 100% of the cases have been studied.

The data of auscultation are reported in the following table:

Table 3: Result of cardiac auscultation

Result of cardiac auscultation	Number of cases	Percentage
continuous murmur at the upper left sternal border	19	76 %
Systolic murmur	4	16 %
pulmonary stenosis murmur	2	8 %



d. Signs of heart failure

No patient of our cases has signs of heart failure

e. The arterial oxygen saturation

The arterial oxygen saturation in ambient air has varied between 92 % and 100%.

2.2. Radiography

2.2.1. Chest X-rays

a. cardiothoracic ratio (CTR)

The CTR in our series ranged between 0.4 and 0.57.

Cardiomegaly was found in 4 patients, or 16% of the cases have been studied.

b. The pulmonary vasculature

The analysis of chest radiographs of patients noted in our series:

A pulmonary hypervascularity in 11 cases.

A normal pulmonary vascularity in 14 cases.

c. Left mid-cardiac border

In our series, left mid-cardiac border is straight in 5 cases.

It is convex in 2 cases, and normal in 18 cases

2.2.2. Transthoracic Echo/Doppler

All patients included in our study benefited from ETT, it was used to study the following parameters:

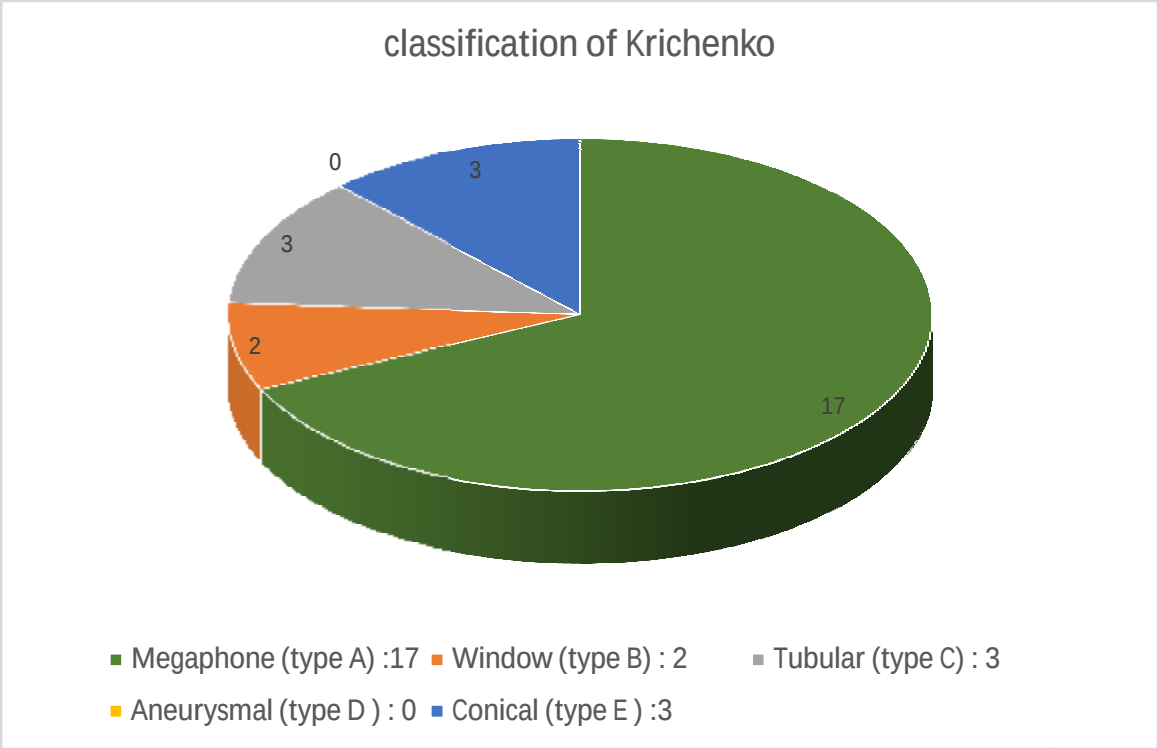
a. Study of the ductus arteriosus

a.1. The channel diameter

The diameter of the ductus arteriosus in our cases ranged between 2mm and 12 mm

Table 4: According to the classification of Krichenko

PDA type	Number of patients	Percentage
Megaphone (type A)	17	68 %
Window (type B)	2	8 %
Tubular (type C)	3	12 %
Aneurysmal (type D)	- -	
Conical (type E)	3	12 %



a.2. maximum Doppler velocity

It varied between 3 and 4.52 m/s .

a.3. shunt direction

The shunt is left -right in 25 cases, or 100 % of the cases have been studied .

b. Left heart chambers

The left hear chambers are dilated in 9 cases, or 36% of the cases have been studied.

c. Right heart chambers

The right heart chambers are dilated in 2 cases, or 8 % of the cases described in our series.

d. Pulmonary arterial hypertension

PAH was found in 4 cases, or 16 % of the cases described in our series.

3. Treatment, Evolution and Post-operative care

Successful PDA closure from 25 patients with ADO device had been achieved in 24 patients (96 %) , unsuccessful attempts was because of the device does not fit the PDA (2 attempts)

Results of transcatheter occlusion of PDA have been excellent, and follow-up generally excellent.

Follow-up:16 months

DISCCUSION

Since Portsmann et al. placed first Evalonfoam plug prosthesis in 1967, every effort had been done to develop a perfect transcatheter method for PDA occlusion. Diverse devices have been designed and some undergone modification according to the experience in their use and effectiveness. The use of these devices avoids the complications related to surgical procedure, diminishes hospitalization time by immediate recovery. It considers that ideal device is the device that uses catheters of low caliber, that has the capacity of retrieving, that with a delivery system which is effective and easily handled, besides to have the smaller percentage of residual shunts. The amplatzer duct occluder device was designed to provide the most desirable characteristics for percutaneous closure device.

I. Study of epidemiological data

1. Age distribution

In our series the mean age of 25 patients are 6.6 years

In previous series by Kim et al.[37], mean age of 150 patients was 2.6 years, the series by Parra-Bravo JR et al. [38], mean age of 39 patients was 1.8 year ,and the series by Jin M, Liang YM[39] mean age of 1526 patients was 4 years .

This proportion is high compared to the literature data .

2. Gender distribution

In our series there is a female predominance with a sex ratio F / M 1.77

These results confirm the literature data

In previous series by Kim et al [37] sex ratio F/M 1.34

In previous series by Parra-Bravo JR [38] sex ratio F/M 1.43

In previous series by Jin M, Liang YM [39] sex ratio F/M 1.84

3. Distribution by weight

In our series the mean weight are 19.4 kg .

Lowest weight is 7kg .

In previous series by Kim et al [37]mean weight is 10.2 kg

In previous series by Jin M, Liang YM [39] Mean weight is 15.3 kg

In previous series by Koch A [40] mean weight of 160 patients is 24.3 kg

4. PDA and notion of consanguinity

In our series, the concept of parental consanguinity was observed in 10 patients or 40% of cases.

These results confirm the literature data

In the study of Mani A, Meraji SM [41],they found that patent ductus arteriosus (PDA), a common congenital heart disease, accounts for a higher fraction of congenital heart disease in Iran (15%) than in the United States (2–7%). Moreover, Iranian PDA cases demonstrated a marked increase of parental consanguinity (63%), compared with the general Iranian population (25%)

In the series of Bouchta.N. [42], 18 % of cases (80 patients) had a parental consanguinity.

II. Diagnosis

1.clinic

a. functional signs

The clinical symptoms vary depending on the importance of the shunt, on the size of the channel and the level of pulmonary vascular resistance.

Table 5: The clinical symptoms according to others authors

Authors	Repeated lower respiratory tract infections	Dyspnea
Chaara [43]	35,29%	35,29%
Laraaki [44]	34,78%	60,86%
Bencherif [45]	19%	38%
Kettani [46]	31,7%	63,41%
Faik [47]	36%	28%
Elmamoun [50]	17,7%	53,2%
Our series	28 %	48 %

b. cardiac auscultation

A typical continuous murmur can be heard at the patients with patent ductus arteriosus, which is the most frequently described in literature.

It was first described in 1847 in "London Medical Gazette" as "murmur that accompanying first sound...extended to the second sound, so there is no interruption of the murmur before the second sound had already started".

Later, in 1900, George Gibson presented a more precise description. "It persists trough the second sound and dies away gradually during the long pause. The murmur is rough and trembling. It begins softly and increases in intensity so as to reach its acme just about, or immediately after, the incidence of the second sound, and from that point gradually wanes until its termination”

Continuous murmurs of patent ductus arteriosus consists of two components: a crescendo systolic one and a decrescendo diastolic one, with a peak of intensity around second sound [48]. It is best heard at second left intercostals space or immediately left infraclavicular. It is continuous because the ductus arteriosus provides a permanent communication between the systemic circulation, with high pressure, and the pulmonary circulation, where pressure level is much lower.

About half of patent ductus arteriosus murmurs in children are not truly continuous and many are only systolic. This is because with the pulmonary vasoconstriction secondary to a large shunt, there is often a moderate degree of pulmonary hypertension, which decreases the aortic–pulmonary artery gradient more in diastole than in systole.

Those with large ductus have been described by Eddy sounds, clicks or crackles at the end of systole and at the beginning of the diastole [49].

Table 6: Result of cardiac auscultation according to others authors

Result of cardiac auscultation	Our series	Elmamoun [50]	Faik[47]
continuous murmur at the upper left sternal border	19 (76 %)	28 (45,16%)	17(34%)
Systolic murmur	4 (16 %)	21 (33,87%)	14 (28%)
pulmonary stenosis murmur	2 (8 %)	------	------

2. Radiography

a. Transthoracic Echo/Doppler data

The echocardiographic findings are typically diagnostic for patent ductus arteriosus (PDA). High velocity jets of turbulent flow in the pulmonary artery can be reliably detected by color flow Doppler imaging; this technique is sensitive in detecting even the small PDA. Relying on alternative imaging techniques to make the diagnosis of this condition is unusual. Additionally, echocardiography provides

important diagnostic information regarding associated congenital cardiovascular malformations.

By 2-dimensional (2-D) echocardiography, the aortic end of the patent ductus arteriosus (PDA) is localized first, and then it is tracked back to the pulmonary artery. Precisely documenting the size, shape, and course of the ductus is difficult.

The patent ductus arteriosus (PDA) can be seen most easily in the parasternal short axis view and from the suprasternal notch. The classic patent ductus arteriosus (PDA) connects the junction of the main pulmonary artery and the left pulmonary artery with the aorta just below and opposite the left subclavian artery.

If no other abnormalities are present, Doppler echocardiography reveals continuous flow from the aorta into the main pulmonary artery. If the magnitude of the left-to-right shunt is large, continued flow around the aortic arch into the ductus arteriosus in diastole and flow reversal in the descending aorta are evident. Also, variable levels of continuous flow in the branch pulmonary arteries related to the magnitude of the shunt are observed. As the shunt magnitude increases, increased flow in the pulmonary veins is evident and the left atrium enlarges. With a small or moderate-sized patent ductus arteriosus (PDA), the left ventricular size is often normal, but as shunt magnitude increases, the left ventricular diastolic size also increases. (Qp/Qs can be calculated using Doppler velocity and left ventricular/right ventricular (LV/RV) outflow tract dimensions.)

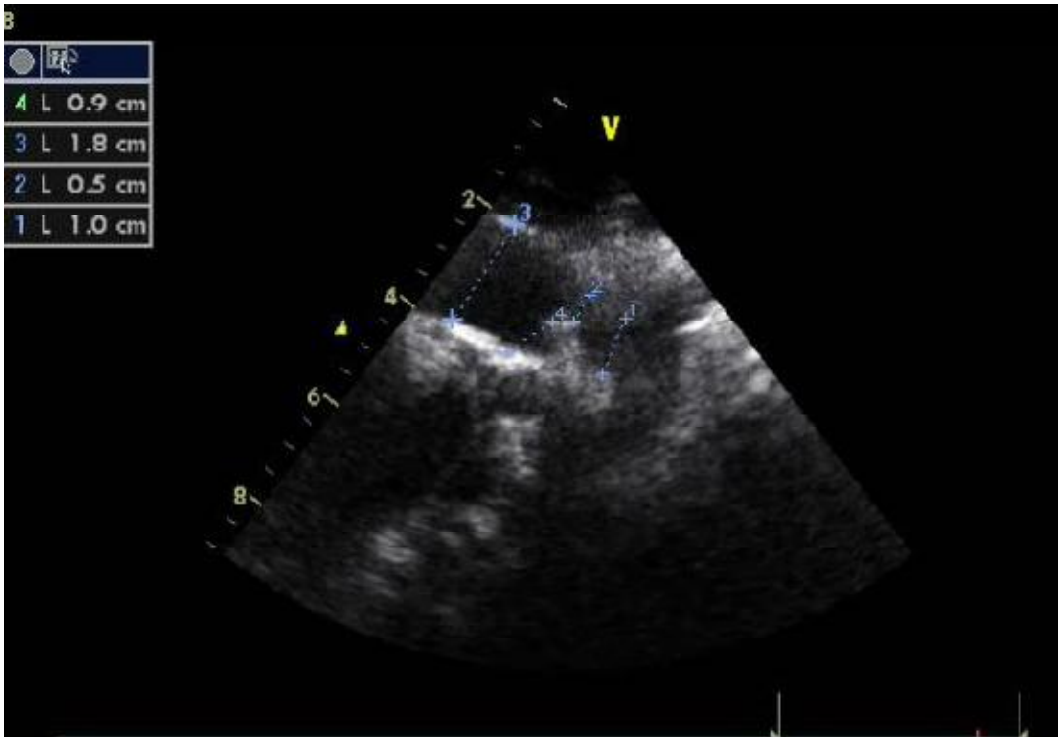


Figure .11 Image du canal artériel en coupe transartériele petit axe, montrant leurs diamètres aortique et pulmonaire.

Figure .12 chez le même patient, une coupe trans-Ventriculaire gauche permet d'évaluer le retentissement de la PCA par l'analyse de la dilatation ventriculaire gauche, et la FR.

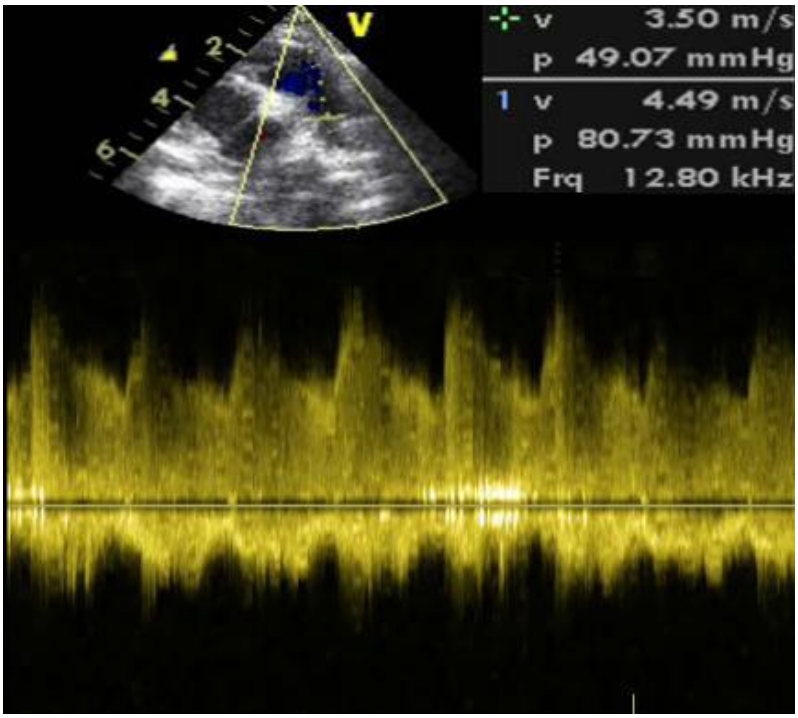


Figure .13 Doppler continu le long de l'axe de PCA. Le flux à la fois systolique et diastolique. La vitesse maximale est élevée de l'ordre de 3.5m/s.

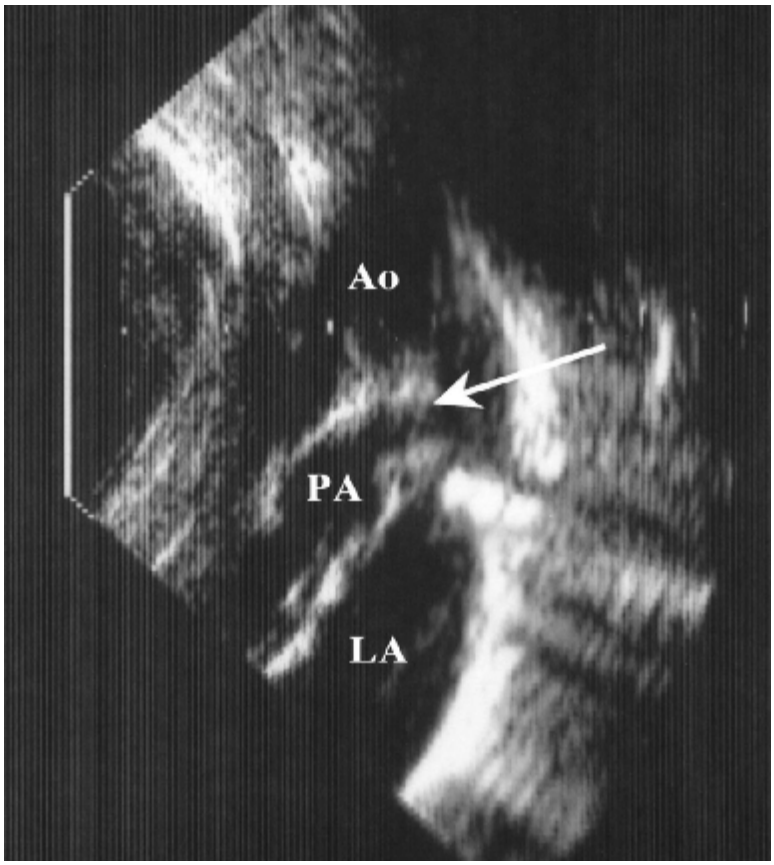


Figure .14 Two-dimensional echocardiogram (suprasternal view). This image shows a large patent ductus arteriosus (arrow) that runs above the left atrium (LA) between the aorta (Ao) and the pulmonary artery (PA)

Table 6: Transthoracic Echo/Doppler features according to others authors

Transthoracic echo/ Doppler features	Our series (25 cases)		Zarriq.s. (90 cases)	Elmamoun (62 cases)
the channel diameter	<4mm	15	66	8
	>4mm	10	44	54
maximum Doppler velocity	<4 m/s	19	36	-
	>4 m/s	6	74	-
dilated left heart chambers		9	38	46
Dilated right heart chambers		2	8	9
PAH		4	34	45

b.Chest ray x features

Chest radiographic features may vary depending on whether it is isolated or associated with other cardiac anomalies and with the direction of shunt flow (right to left or left to right). Can have cardiomegaly (predominantly left atrial and left ventricular enlargement if not complicated). Obscuration of the aortopulmonary window and features of pulmonary oedema may be evident

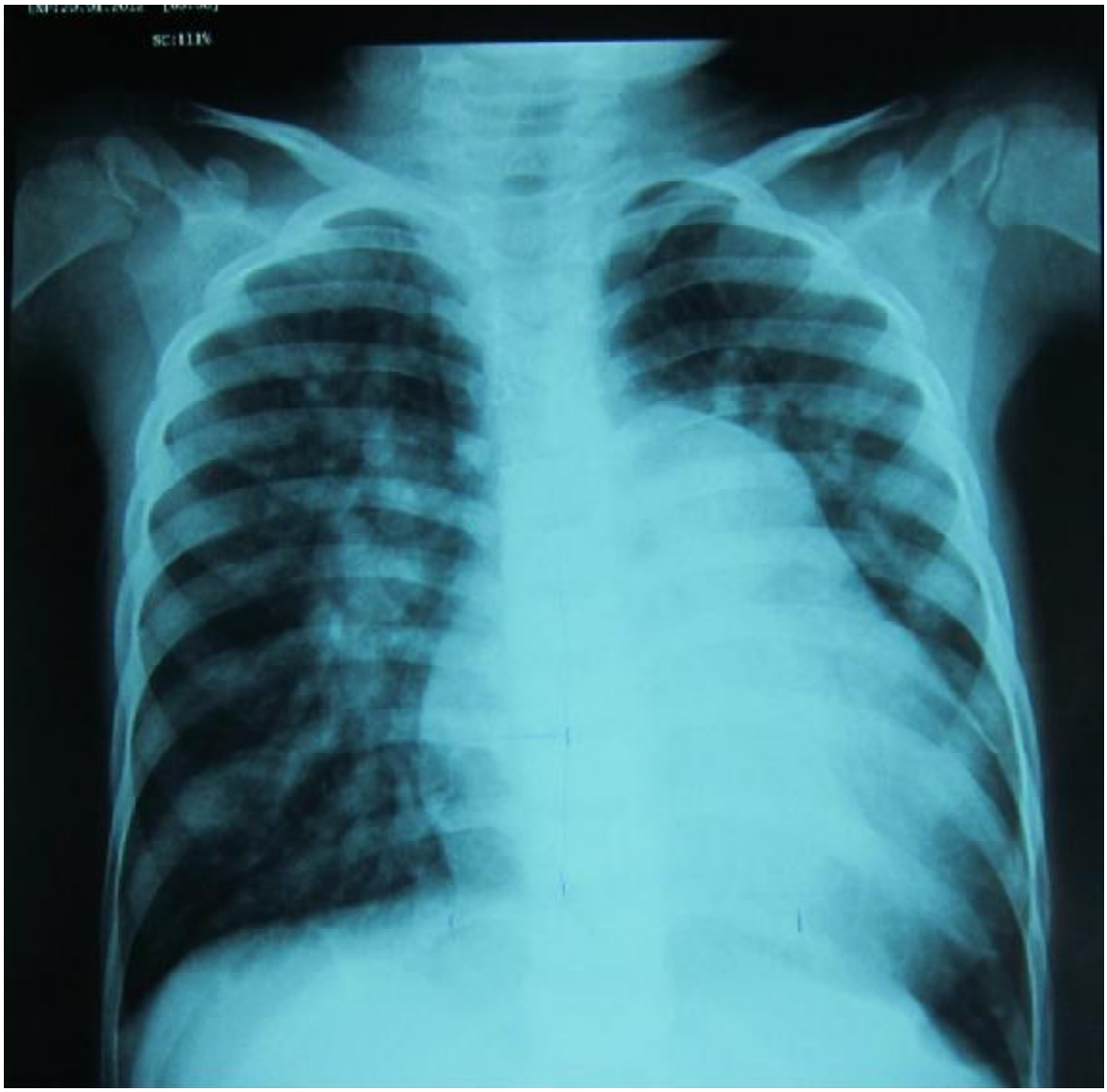


Figure .15 Chest X-ray of a 2 year old, showing cardiomegaly (CTR = 0.57) , straight left mid-cardiac border, and A pulmonary hypervascularity

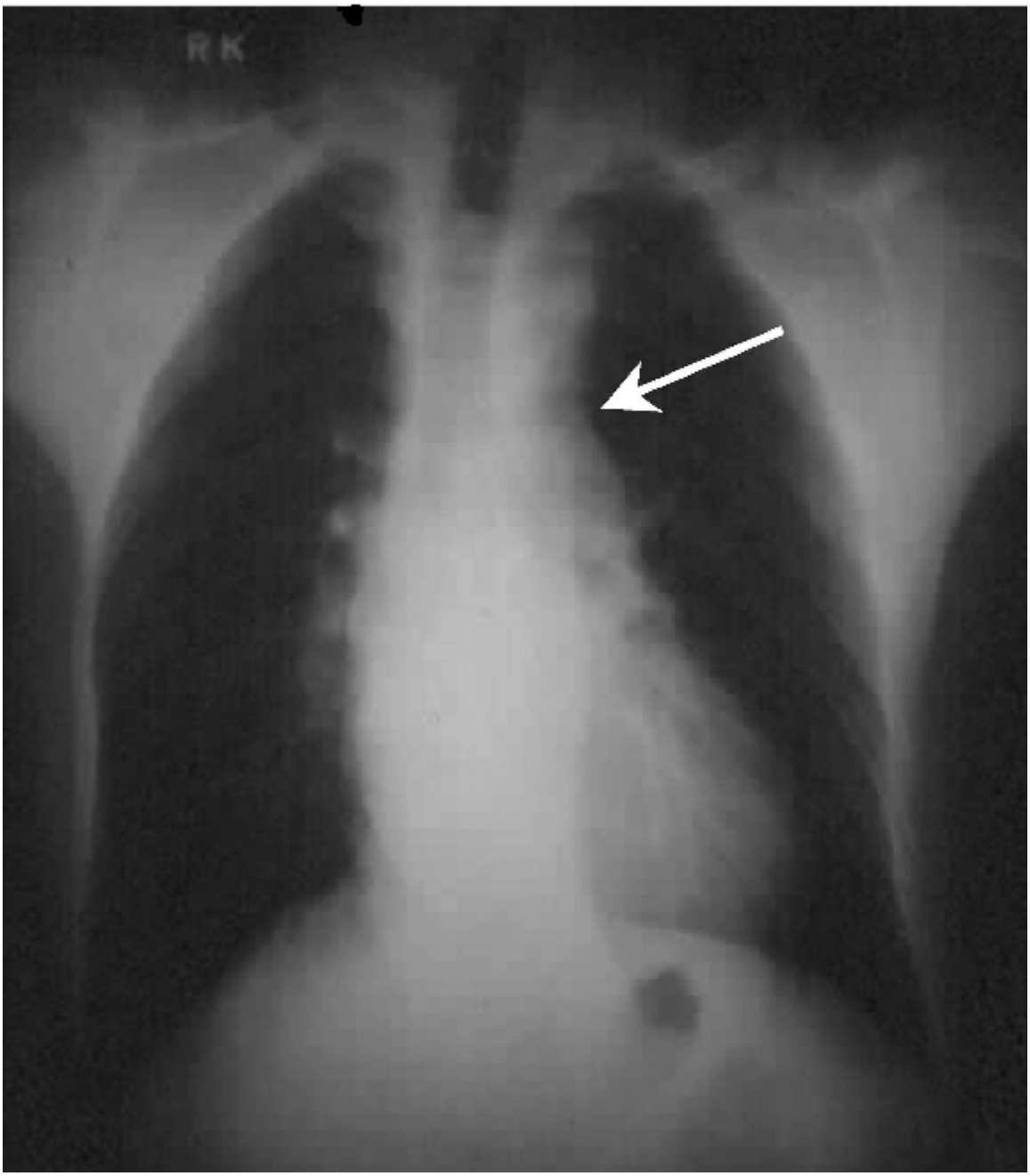


Figure .16 Frontal chest radiograph in a patient with patent ductus arteriosus. This image shows filling in of the aorto-pulmonary window (arrow)

III. Treatment, Evolution and Post-operative care

The first transcatheter closure of PDA was performed by

Portsman et al. in late 1960s. This initial work was continued by Rashkind et al. in late 1970s, after which it is performed and developed worldwide.

We found that PDA transcatheter closure has a high success rate and rarely causes major complication in most of the cases.

Successful PDA closure from 25 patients with ADO device had been achieved in 24 patients (96 %) , unsuccessful attempts was because of the device does not fit the PDA (2 attempts)

Results of transcatheter occlusion of PDA have been excellent, and follow-up generally excellent.

Previous studies have shown that transcatheter closure of PDA is quite an established technique with no reported mortality and low morbidity.

A retrospective case series of1808 patients undergoing transcatheter closure of PDA showed that overall PDA closure rate was 94 %, and the

rate of major average events were 1.5 % [51].

Annex (1) Anesthesia for patent ductus arteriosus closure (French)

Dans ce cas, le but de l'anesthésie est d'assurer une immobilité de l'enfant puisque le geste se fait par ponction des vaisseaux fémoraux sous anesthésie locale éventuellement après application d'un produit actif par voie transcutanée [52]. Selon l'âge de l'enfant, parfois une simple sédation sera suffisante [52]. Si la réalisation d'une anesthésie générale s'avère nécessaire, l'induction est souvent réalisée par administration de sévoflurane qui permet la mise en place d'abord sanguine. Ensuite, le maintien de l'anesthésie peut être effectué selon la même technique ou par voie intraveineuse (midazolam, propofol) selon l'âge du patient et les habitudes du centre. L'enfant peut être laissé en ventilation spontanée avec un masque laryngé ; certains préfèrent l'intubation trachéale qui peut nécessiter parfois une relaxation musculaire et/ou une ventilation assistée. Dès la fin de l'induction anesthésique, une prophylaxie de l'endocardite infectieuse doit être effectuée. En fin de procédure, l'enfant sera transféré en salle de surveillance post interventionnelle pour une surveillance classique du réveil en s'assurant toutefois de l'absence d'hémorragie au point de ponction.

Dans certains centres, ce geste est effectué en ambulatoire, la décharge de l'hôpital étant autorisée à partir de la 6e heure après la fin de la procédure et après la réalisation d'une échocardiographie de contrôle. Les complications de ce geste sont rares et peuvent nécessiter la réalisation d'une intervention chirurgicale immédiate ou différée comme dans le cas d'un déplacement ou d'une migration de la prothèse. La rupture est une éventualité forte heureusement théorique qui nécessiterait une intervention en extrême urgence. Enfin, quelques cas d'hémolyse ont été rapportés [52]. Ils correspondent le plus souvent à une obstruction initialement incomplète du canal artériel.

Figure .17 Matériels d'Anesthésie

Annex (2) Procédure d'implantation de la prothèse d'Amplatz (french)

Le cathétérisme est effectué sous simple sédation et anesthésie locale.

Après mise en place dans l'artère fémorale d'un introducteur de 4 à 5 F, une sonde NIH ou une sonde pigtail permet d'effectuer une aortographie en amont du canal artériel en incidence latérale et de mesurer son plus petit diamètre. Par voie veineuse fémorale et dans un introducteur 6 F, on atteint l'artère pulmonaire, puis l'aorte descendante, en franchissant le canal artériel avec une sonde à bout distal. Un guide rigide d'échange est positionné dans l'aorte descendante et l'ensemble sonde et introducteur veineux est retiré de la veine. On choisit une prothèse dont la taille est supérieure de 2 mm à celle du diamètre ductal minimal et on la visse au câble de chargement. Pour les canaux artériels dont la forme et le calibre sont difficiles à évaluer en angiographie, on peut calibrer le diamètre du canal à l'aide d'un ballon long et souple gonflé dans le canal, ce qui permet de le mesurer de façon précise et de choisir la prothèse adaptée. Une gaine de largage (AGA) 6 F et son dilatateur sont montés sur le guide rigide jusqu'à l'aorte thoracique descendante sous scopie en projection latérale. Le dilatateur et le guide sont ensuite retirés et la prothèse est chargée dans la gaine. On avance la prothèse jusqu'à l'aorte descendante. Le déploiement de la collerette distale est effectué dans cette partie de l'aorte en tirant sur la gaine. Ensuite, le système entier est tiré fermement contre l'orifice aortique du canal. La partie cylindrique de la prothèse est déployée dans le canal en tirant à nouveau sur la gaine. Le bon positionnement de la prothèse est vérifié avant le largage par une injection de produit de contraste dans l'aorte. Une dose de 100 UI/kg d'héparine ainsi qu'une prophylaxie antibiotique sont administrées pendant le cathétérisme. Le patient reste en hospitalisation pendant 24 heures après le cathétérisme. Avant la sortie, les sujets subissent une radiographie du thorax et une échographie de contrôle à la recherche d'un shunt résiduel.

Figure .18 Salle de KT Interventionnel –CHU HASSAN II- FES

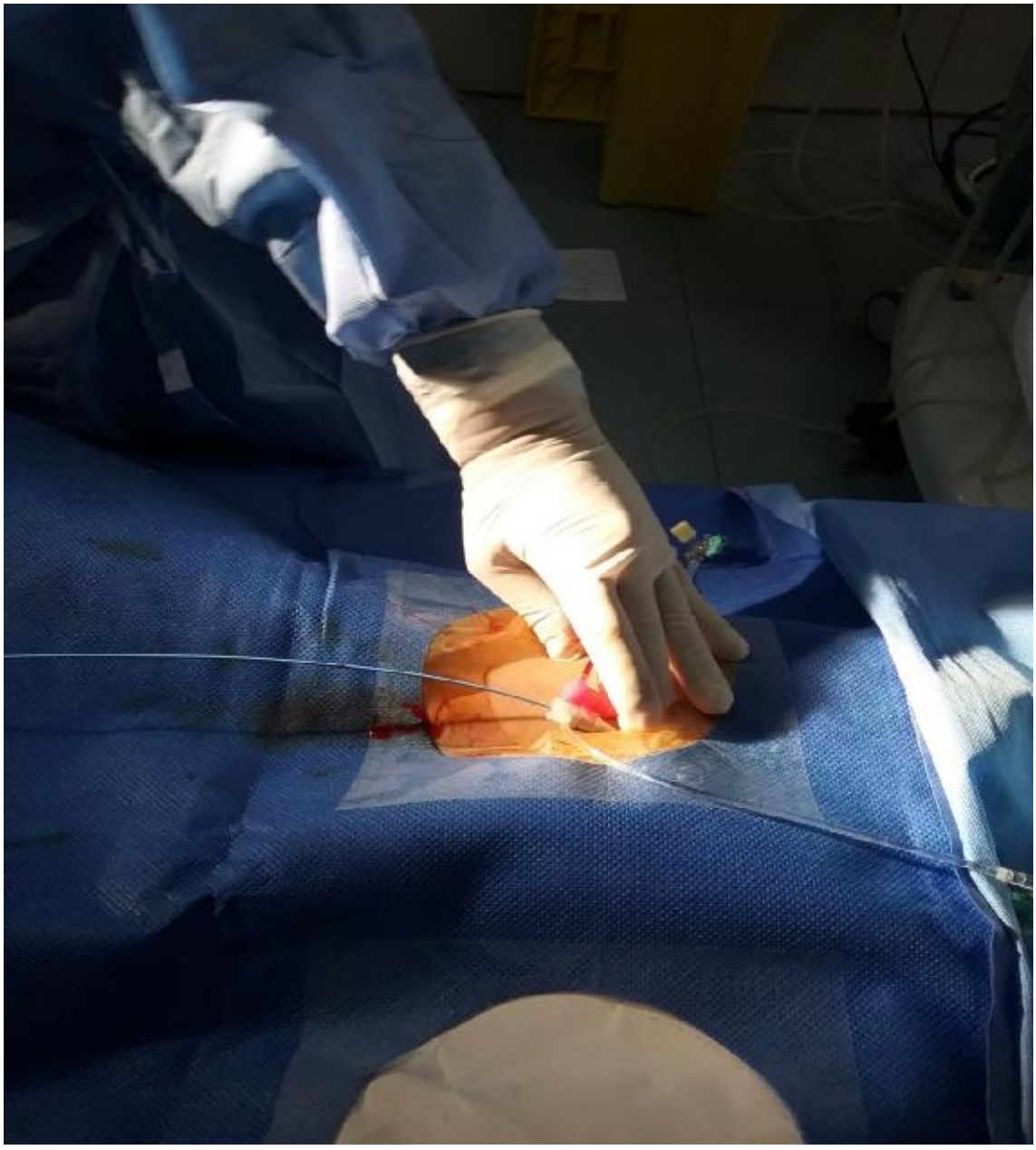


Figure .19 Mise en place des inducteurs fémoraux.

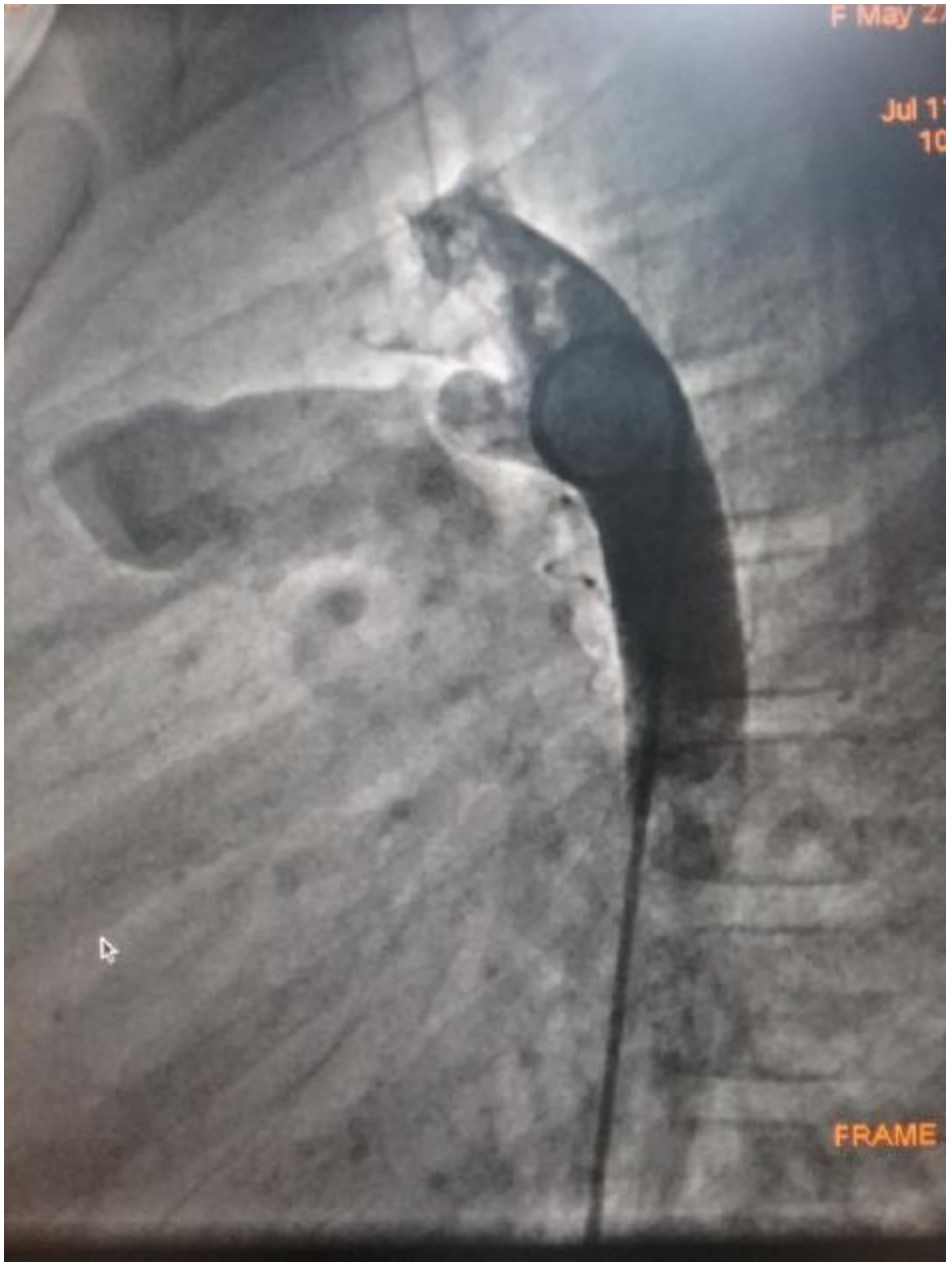


Figure .20 Vue latérale agiographique de canal artériel ,l'aorte ;l'artère pulmonaire Canal artériel type A "classification de Krichenko et al "

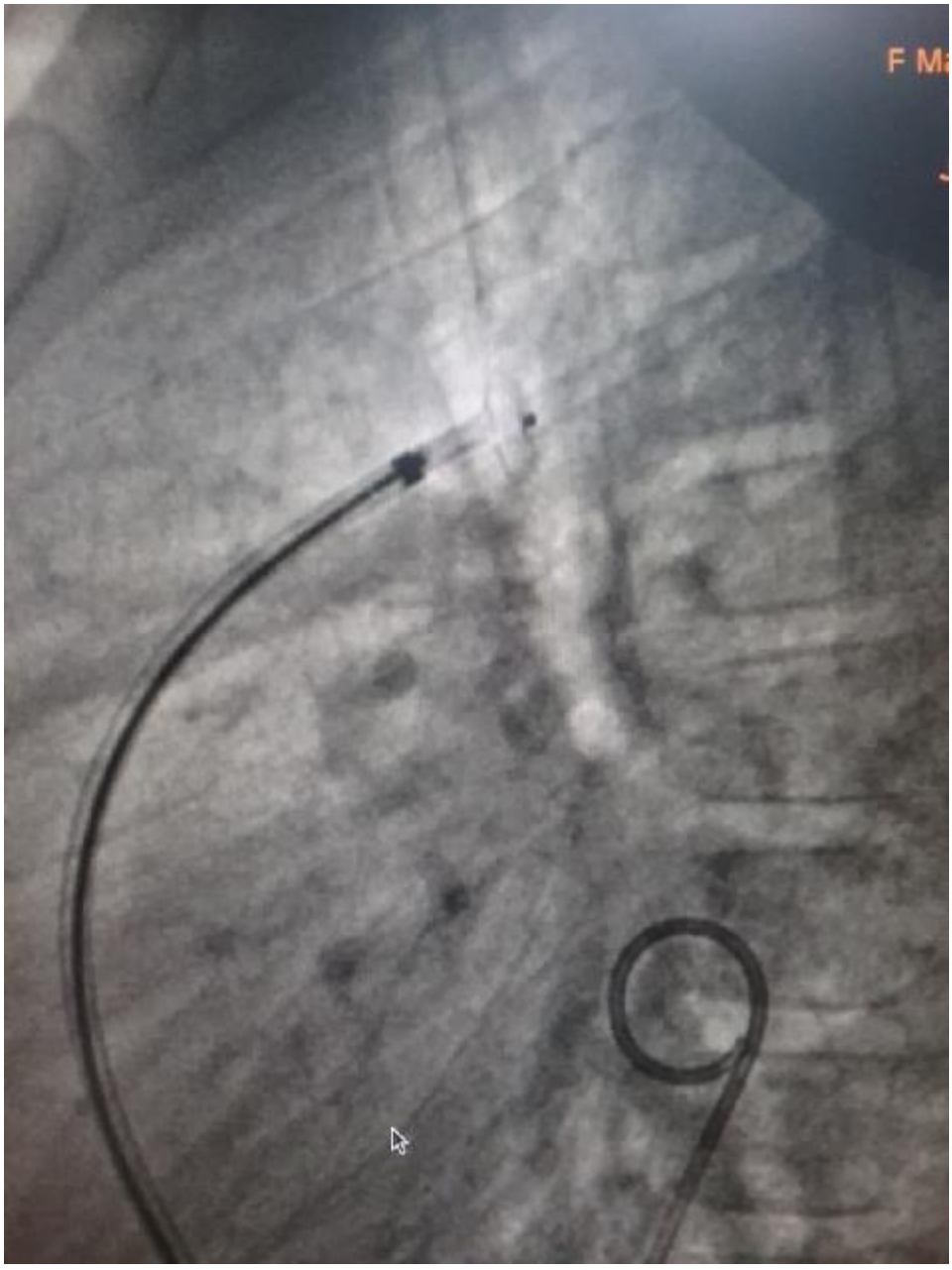


Figure .21 Largage du premier disque "coté aortique "

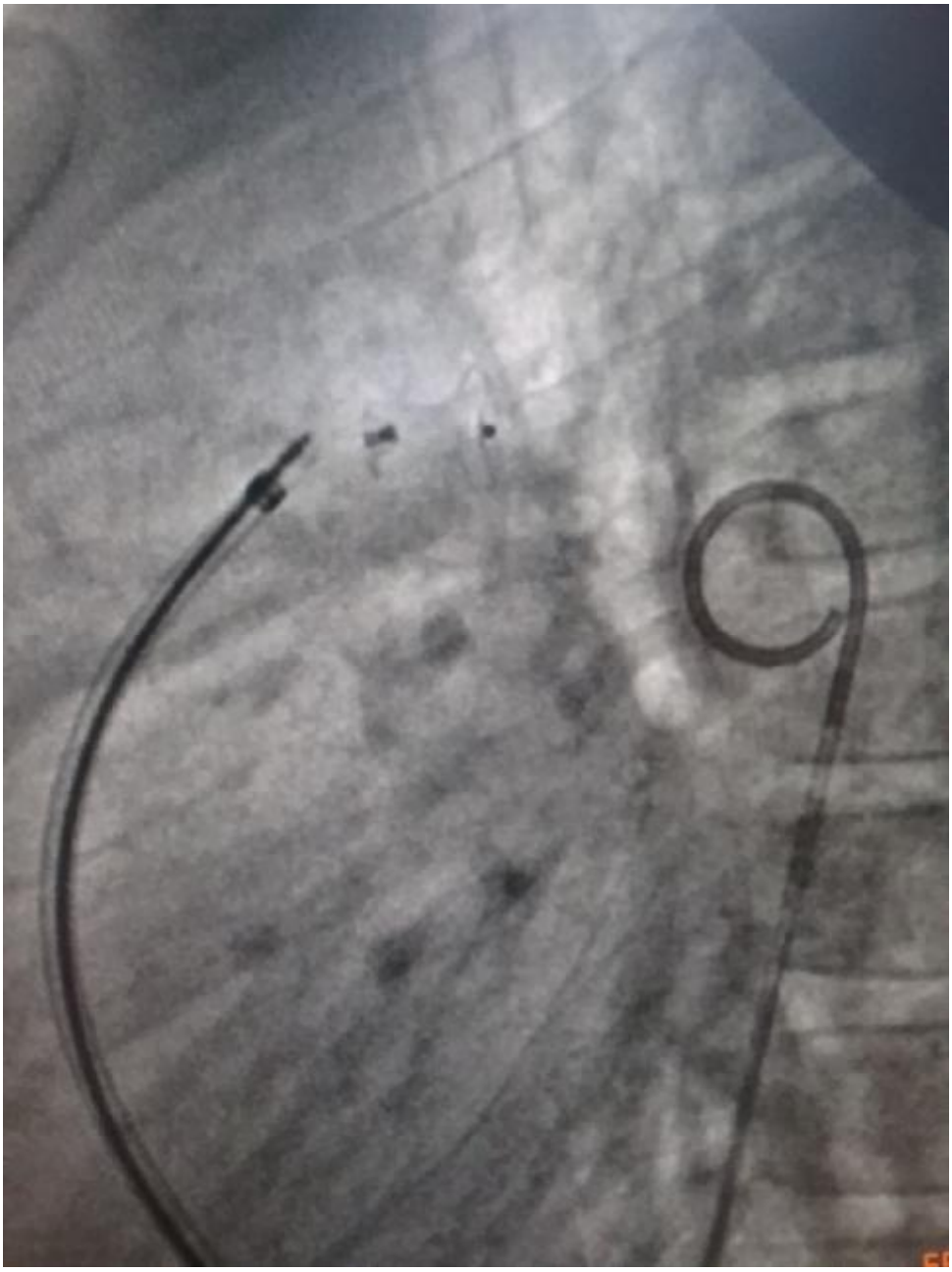


Figure .22 Largage du deuxième disque "coté pulmonaire "

Figure .23 Equipe de cathé pédiatrique

Médecins:

Pr Atmani Samir	Professeur agrégé de pédiatrie .
Pr Harrandou Mustapha	Chef de service de reanimation mere-enfant
Pr Labib Smail	Service de reanimation mere-enfant
Pr Berdai Adnan	Service de reanimation mere-enfant
Dr Berrada Aicha	Résidante de service de reanimation M-E
Dr Bazine myriame	Résidante de service de reanimation M-E
Dr Touzani soumaya	Résidante de service de reanimation M-E

Infirmier :

Mr Abdelali Mahfoud	Infirmier polyvalent
Mlle Qadida Khadija	Aide soignante

Conclusion

Our work focused on 25 cases of percutaneous closure of the arterial duct using the Amplatzer device, in Pediatric Medical and Surgical Unit – University Hospital Hassan II -Fez , from October 2013 to July 2016.

Epidemiological Aspect

The patients were aged between 1year and 15 years, with mean age (6.6 year).

A female predominance with a sex ratio F/M 1.77.

The patients were weighed between 7kg and 45 kg, with mean weight (19.4kg).

Etiological Aspect

The notion of parental consanguinity is noted in 40% of cases.

Five patients had Down syndrome (Trisomy 21) .

Two cases had a SGA at birth (Small for gestational age).

One patient had congenital rubella.

Clinical Outcomes

The clinical symptoms dominated by dyspnea, feeding difficulties, and repeated lower respiratory tract infections.

The outcome of cardiac auscultation, 76% of cases had a continuous murmur at the upper left sternal border ,16 % had a systolic murmur .

Transthoracic Echo/Doppler & chest ray X outcomes

Cardiomegaly was found in 4 patients, or 16% of the cases .

The diameter of the ductus arteriosus in our cases ranged between 2mm and 12 mm.

The shunt is left-right in 100 % of our cases.

The left hear chambers are dilated in 9 cases.

PAH was found in 4 cases.

Treatment, Evolution

Successful PDA closure from 25 patients with ADO device had been achieved in 24 patients (96 %) , unsuccessful attempts was because of the device does not fit the PDA (2 attempts)

Results of transcatheter occlusion of PDA have been excellent, and follow-up generally excellent.

ABSTRACT

Summary

Title : Transcatheter Closure of Patent Ductus Arteriosus .

Author : Mahmoud Mohammed .

Keywords: Patent ductus arteriosus; Diagnosis ;Transcatheter occlusion; Amplatzer duct occlude.

Percutaneous occlusion of patent ductus arteriosus (PDA) has become increasingly attractive with the evolution of devices and techniques.

We conducted a retrospective study was carried out in Pediatric Medical and

Surgical Unit - University Hospital Hassan II -Fez, from October 2013 to July 2016,during which 25 patients who underwent cardiac catheterization in an attempt to close the PDA by transcatheter approach using amplatzer duct occluder device .

These 25 cases are divided according to the gender into 16 girls and 09 boys with a sex ratio of 1.77 .

The age varies from 1 year to 15 years with an average age of 6.6 years.

The weight varies from 7 kg (lowest weight) to 45 kg with an average age of 19.4 kg.

On the etiological aspect , the concept of consanguinity was found in 40 % of cases .

Trisomy 21 is the most common chromosomal aberration in our study 20 % .

The clinical symptoms are variable according to the importance of the left to right shunt through the canal .

Echocardiography is an important diagnostic tool and is a mainstay for the diagnosis and evaluation prior to management .

The classification of Krichenko et al. demonstrates the wide variability in patent ductus size and configuration using the angiographic to help guide

transcatheter closure procedure .

The treatment is essentially by transcatheter approach using amplatzer duct occluder device .

This Device was successfully deployed in 96% of patients .

short- and long-term outcomes following transcatheter are generally excellent.

Résumé

Titre: fermeture du canal artériel persistant par cathétérisme interventionnel.

Auteur: Mahmoud Mohammed.

Mots-clés: canal artériel; Diagnostic ;KT interventionnel ; prothèse d 'amplatz.

La fermeture du canal artériel persistant (CPA) par cathétérisme interventionnel est de plus en plus pratiquée grâce à l'évolution de nouvelles techniques et dispositifs.

Nous avons mené une étude rétrospective portant sur 25 patients ayant bénéficié d'un traitement par KT interventionnel à l'unité médicochirurgicale cardio-pédiatrique, service de pédiatrie, CHU Hassan II Fès, entre octobre 2013 et juillet 2016.

Ces 25 cas sont répartis selon le sexe en 16 filles et 09 garçons avec un sex-ratio de 1,77.

L'âge varie de 1 an à 15 ans, avec un âge moyen de 6,6 ans.

Le poids varie de 7 kg (poids le plus faible) à 45 kg avec un poids moyen de 19,4 kg.

Sur le plan étiologique, la notion de consanguinité est retrouvée dans 40% des cas.

La Trisomie 21 est l'aberration chromosomique la plus retrouvée dans notre étude de (20 %) .

Les symptômes cliniques sont variables selon l'importance du shunt gauche - droite à travers le canal.

L'échocardiographie est un outil important de diagnostic et est un pilier pour le diagnostic et l'évaluation préalable à l'intervention.

La classification de Krichenko et al. démontre une grande variabilité de la taille et de la forme du canal persistant en utilisant l'angiographie, et permet de guider la procédure de fermeture percutanée.

Le traitement repose essentiellement sur un transcathétérisme en utilisant une prothèse d'Amplatz.

Le dispositif a été mis en place avec succès dans 96% des patients.

Les résultats de suivi à court et à long terme sont généralement excellents.

ملخص

العنوان : إغلاق القناة الشريانية المفتوحة بواسطة القسطرة .

المؤلف : محمد محمود .

الكلمات الأساسية: القناة الشريانية المفتوحة, التشخيص, القسطرة القلبية, جهاز AMPLATZ.

إن إغلاق القناة الشريانية المفتوحة بواسطة القسطرة له أهمية متزايدة بعد تطور أجهزة القسطرة وتقنياتها.

أجرينا دراسة بأثر رجعي "دراسة استعادية" شملت 25 طفلا خضعوا للعلاج بالقسطرة القلبية التداخلية في المدة من أكتوبر 2013 حتى يوليو من عام 2016 بوحدة القلب والعلاج بالقسطرة التابعة لقسم الأطفال بمستشفى الحسن الثاني الجامعي بمدينة فاس.

تنقسم هذه الحالات حسب الجنس إلى 16 طفلة و9 أطفال ذكور, بحيث كانت نسبة الإناث للذكور تساوي 1.77

تتراوح أعمارهم ما بين عام واحد و15 عاما, بمعدل أعمار يساوي 6.6 سنوات.

وتتراوح أوزانهم ما بين 7 كيلوجرام ووزن 45 كيلوجرام, بمعدل وزن يصل إلى 19.4 كيلوجرام.

فيما يخص العوامل المسببة لهذا المرض أظهر بحثنا أن 40% من الأطفال المشمولين بالدراسة هم نتاج زواج الأقارب وعند البحث عن الأمراض المصاحبة أظهر بحثنا أن 20% منهم يعانون من ثلاثي الصبغي 21.

كما أن الأعراض السريرية تباينت من حالة إلى أخرى نظرا لاختلاف حجم القناة الشريانية المفتوحة.

إن تخطيط صدى القلب يعتبر أداة تشخيص رئيسية للمرض كما أنها أداة مهمة في تحديد العلاج والمتابعة.

صنف التصوير حسب تصنيف Krichenko وآخرون شكل القناة الشريانية المفتوحة ويعتبر التصوير الوعائي بذلك ذا أهمية في العلاج بالقسطرة.

جميع الأطفال المشمولين بالدراسة تم علاجهم باستخدام جهاز "AMPLATZ" بنسبة نجاح تصل إلى 96 %.

وأخيرا فقد أظهر بحثنا أن العلاج بالقسطرة تقنية فعالة وآمنة على المدى القصير والطويل.

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