J Vet Clin 28(2) : 240-243 (2011)

Journal of Veterinary Clinics
www.ksvc.or.kr

Transcarotid Coil Embolization in a Yorkshire Terrier Puppy with Patent Ductus Arteriosus Using a JR Coronary Catheter and Free Push Deployment System

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(Accepted: April 16, 2011)

Abstract : Several vascular accesses can be used for catheter guided coil embolization for occluding patent ductus arteriosus (PDA). Although trans-femoral approach is most commonly used in dogs, it is often unable to insert angiocatheter for inserting the coil delivery system, especially small puppies weighing less than 2 kg of body weight. Therefore this case study developed trans-carotid method for puppy using JR coronary catheter and free push delivery system. Using this new method, we successfully treated a puppy with PDA weighing 1.25 of body weight.

***Key words* :** coil embolizing, JR coronary catheter, ductus closure, non-detachable delivery system, PDA.

Introduction

Patent ductus arteriosus (PDA) is the most common congenital cardiac defect in the dog and is characterized by continuous machinery left basal murmur and left ventricular (LV) elongation with classical triple bumps (1). Traditionally, most cases of PDA were corrected by surgical ductal ligation via lateral thoracotomy, although it often resulted in the morbidity associated with thoracotomy, due to several complications of ductal ligation including hemorrhage, ductal rupture, incomplete ligation and recanalization (2-4). Transcatheter techniques such as coil embolization and Amplatz-type occluders were developed to minimize perioperative morbidity. Among those transcatheter techniques, the coil embolization is the most commonly employed transcatheter technique for PDA occlusion in both the dog and man (5-6). Major problem encountering coil embolization in puppy is a difficulty of vascular access, because small puppies generally have tiny femoral arteries which are not enough to accommodate the coil delivery system.

To overcome this problem of coil embolization, we developed a new method of coil embolization for small puppies, using carotid artery (vascular access) and free push delivery system (requiring smaller diameter of delivery system).

Case

The patient was a 5 month-old female Yorkshire terrier (weighing 1.25 kg). The dog was referred with loud heart murmur and exercise intolerance. In physical examination, typical continuous quality cardiac murmurs (grade V/VI) were detected over the left basal area. No significant abnormalities were observed in complete blood count (CBC) and serum biochemistry, except hypoalbuminemia (2.3 g/dL, reference range 2.5-4.4 g/dL). The 12 lead-surface ECG revealed typical findings of left ventricular enlargement (tall and wide QRS complexes). Diagnostic imaging studies revealed the elongation of left ventricle with classic triple bumps on the main pulmonary artery (MPA), aorta (Ao) and left atrium (LA) on the dorsoventral view of radiograph (Fig 1A). Echocardiography revealed abnormal duct (3-5 mm, depending on location and echocardiographical views; Fig 1C), continuous turbulent shunt flow between the aorta (Ao) and pulmonary artery (PA) on continuous wave (CW) Doppler echocardiography at the pulmonary artery level (maximal velocity of pulmonic regurgitant 3.1 m/s; Fig 1B) with flow direction from left to right chamber.

Based on diagnostic findings, this case was diagnosed as left to right PDA. We decided to occlude the PDA by coil embolization because the femoral artery of the patient was too narrow to use Amplatz ductal occluder (which is a minimal size delivery catheter for Flipper coil controlled delivery system). The transcarotid coil embolization was developed using a JR coronary angiocatheter (accepting wire diameter up to 0.038" wire) with a 5 mm (3 loops) embolization coil and free push delivery system.

For general anesthesia, the dog was premedicated with butorphanol (0.2 mg/kg, IV) followed by a propofol induction (5 mg/kg, IV) and propofol maintenance (0.6 mg/kg/min). Atropine was not used, because this dog was tachycardic. After achieving surgical anesthesia, the right carotid artery was exposed

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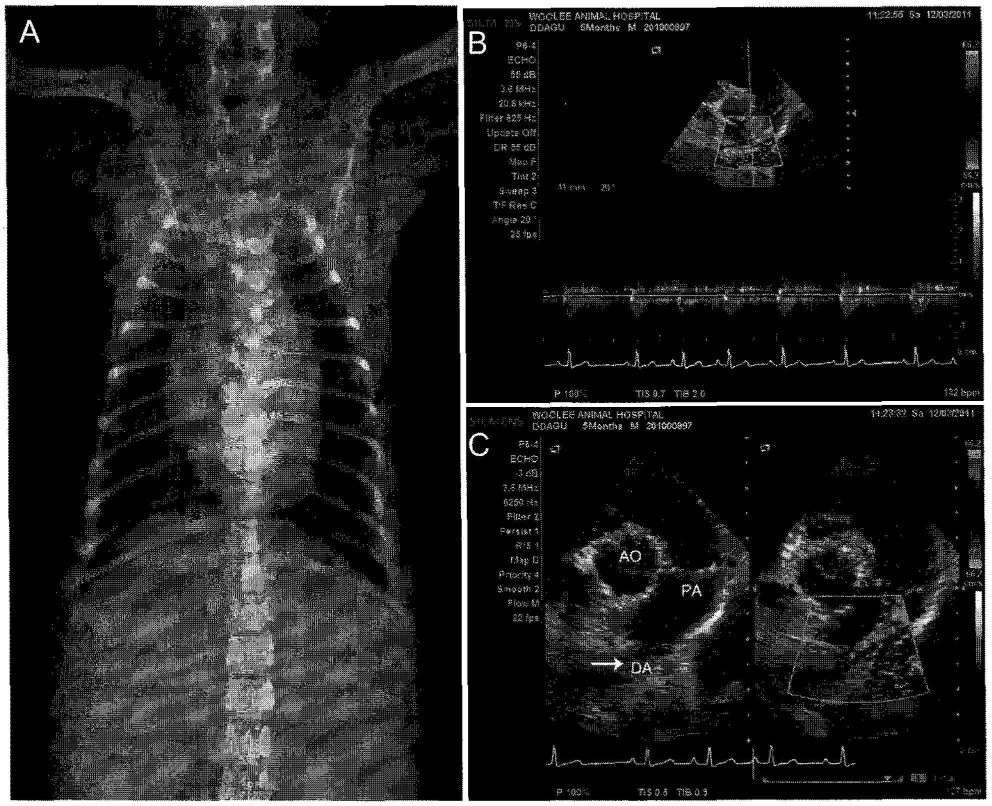

Fig 1. Diagnostic imaging studies of Case 1. A: Thoracic radiography revealed elongation of left ventricle and moderate dilation of main pulmonary trunk. B: Continuous wave Doppler echocardiography at the pulmonary artery level revealed continuous turbulent shunt flow between the aorta and pulmonary artery (maximal velocity of pulmonic regurgitant 3.13 m/s). C: 2D-echocardiography revealed patent ductus arteriosus (3-5 mm, depending on location and echocardiographical views) and turbulent flow at the ductus.

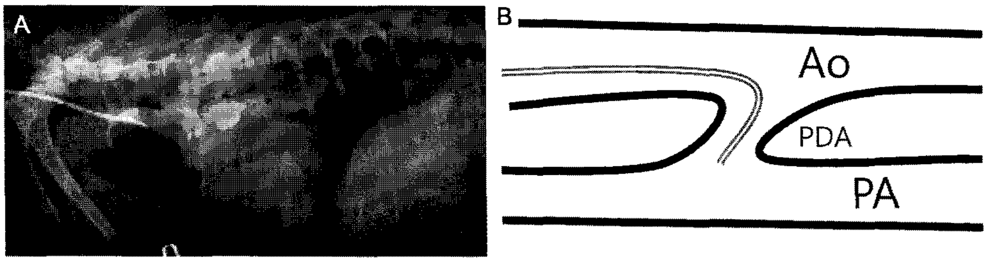

Fig 2. Procedure of transcarotid coil embolization in this case. A: Along with pre-installed guide-wire, JR coronary catheter (Cook medical, USA) was then inserted into the carotid artery with aid of vein lifter (St. Jude medical, USA) and located at the ductus arteriosus with the guidance of fluoroscopy. B: The tip of catheter was located and anchored at the inlet of ductus, then a 5 mm (3 loops) embolization coil (Detachable embolization coils; Cook, USA) was pushed into the ductus using a guide wire (Cook, USA). Ao (aorta), PDA (patent ductus arteriosus), PA (pulmonary artery).

surgically and 18G intravenous catheter was inserted into the exposed carotid artery. Then a guide-wire (0.038" Fixed Core Wire Guides; Cook, USA) was inserted into the catheter and located at the descending aorta. Along with pre-installed guide-wire, JR coronary angiocatheter (Cook medical, USA) was then inserted into the carotid artery with aid of vein lifter (St. Jude medical, USA) and located and anchored at the ductus arteriosus with the guidance of fluoroscopy (Fig 2). After the shunt was visualized with contrast medium (Iohexol, Omnipaque 350; Sampoong, Korea), a 5 mm (3 loops) embolization coil (0.038" Flipper detachable embolization coils; Cook medical, USA) was then inserted into the angiocatheter using a 0.038" guide-wire. The coil was then released inside the ductus. After the coil is completely deployed, the occlusion of PDA was confirmed by disappearance of heart murmur and amount of shunt flow on echocardiography.

The thoracic radiography taken after the coil embolization revealed successful occlusion of PDA (Fig 3A). Continuous quality loud cardiac murmur disappeared immediately after the embolization coil occlusion. On the echocardiography taken at

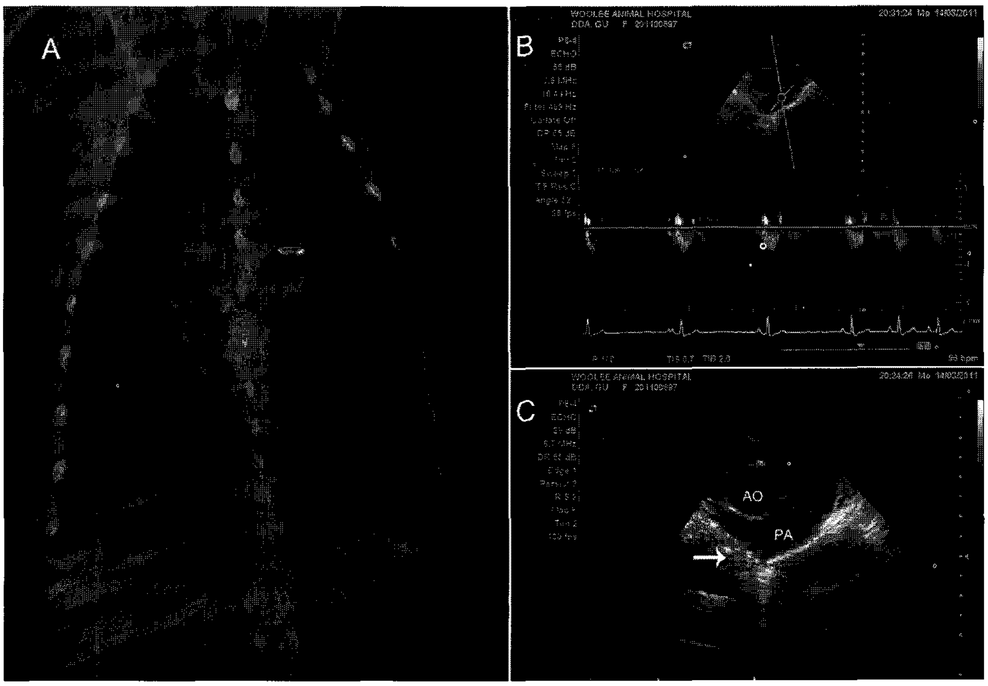

Fig 3. Diagnostic imaging studies after successful coil embolization in this case. A: The thoracic radiography taken after the coil embolization revealed successful occlusion of PDA. B: Continuous wave Doppler echocardiography revealed minimal residual shunt at the ductus arteriosus. C: 2D echocardiography revealed successful occlusion of ductus arteriosus. Arrows indicate embolization coils at the ductus arteriosus.

the first day after the transcatheter coil embolization, no significant shunt flow was detected on the echocardiography (Fig 3B-C). The next day of coil embolization, the dog was released without medication. On the clinical examination performed a month after the coil embolization, the dog gained body weight (3 kg) and had no clinical signs related to PDA.

Discussion

There have been a variety of techniques and methods described for transcatheter PDA occlusion in the dog (7-11). Transcatheter occlusion of the PDA can be approached from the aorta via a peripheral artery (technically easier) or from the main pulmonary artery via a peripheral vein (technically more complicated; 7, 11). The most common approach for PDA coil embolization in the dog is from the aorta via the femoral artery (11). Using femoral artery, the location of PDA is easier, because the angle between the PDA and the tip of catheter runs the same direction. However, using carotid artery, the location of PDA is much more difficult, because the angle between the PDA and the tip of catheter runs the opposite direction. Therefore the delivery catheter is often kinked at the PDA and thus is not able to push into the pulmonary artery. Therefore the hook-type catheter is often useful for the location of the delivery system at the PDA. In this case study, we also found difficulty for locating PDA using the commonly used angiocatheters. The JR coronary angiocatheter was designed to locating the right coronary artery and has the unique hook shaped tip which is useful for locating reversely angled vessels. In this case study, we could locate the reversely angled PDA (from carotid artery) with this catheter without difficulty.

Two techniques routinely used for coil deployment such as a controlled release (CR) and a free push (FP). The CR deployment systems facilitate safe coil repositioning or removal if necessary (6,8,9,11). The differences between specific CR techniques are related to the method of attachment of the coil to the delivery device and the size of the coils that can be deployed with the system. The FP technique utilizes a guide wire to push the embolization coil through a catheter for the coil deployment. The disadvantage with the FP technique is reduced control of the coil during delivery, is unable to reposition or remove the coil as with the CR technique. The advantage of the FP technique is reduced expense and utility in smaller catheters allowing PDA coil embolization in smaller patients than with the CR technique as noticed in this case study. Because this case of dog was a small puppy weighing 1.25 kg, the only option for coil embolization was transcarotid access and JR coronary angiocatheter with FP deploy system (since the CR system required larger bore catheter). Although the deployment of the coil was required more accurate location of PDA (because this deployment system did not allow the repositioning of coil), we could successfully deploy the coil inside the PDA (rather than the PA in the CR system) with the fluoroscopic guidance.

Although several complications related to the coil embolization have been documented (4-6), this case of dog did not show any major complications except minimal residual shunts (which was gradually disappeared with time). The clinical condition of dog was immediately improved after the PDA occlusion (her body weight was doubled one month after PDA occlusion). This is the first case study described the successful PDA occlusion in a puppy using FP coil deployment system and JR coronary angiocatheter.

Reference

1. Patterson DF. Epidemiologic and genetic studies of congenital heart disease in the dog. Circ Res 1968; 23: 171-202.
2. Eyster GE, Eyster JT, Cords GB, Johnston J. Patent ductus arteriosus in the dog: Characteristics of occurrence and results of surgery in one hundred consecutive cases. J Am Vet Med Assoc 1976; 168: 435-438.
3. Van Israel N, Dukes-McEwan J, French AT. Long-term follow-up of dogs with patent ductus arteriosus. J Sm Anim Pract 2003; 44: 480-490.
4. Stanley BJ, Luis-Fuentes V, Darke PG. Comparison of the incidence of residual shunting between two surgical techniques used for ligation of patent ductus arteriosus in the dog. Vet Surg 2003; 32: 231-237.
5. O'Donnell C, Neutze JM, Skinner JR, Wilson NJ. Transcatheter patent ductus arteriosus occlusion: Evolution of techniques and results from the 1990s. J Paed Child Health 2001; 37: 451-455.
6. Glaus TM, Martin M, Boller M. Catheter closure of patent ductus arteriosus in dogs: Variation in ductal size requires different techniques. J Vet Cardiol 2003; 5: 7-12.
7. Fox PR, Bond BR, Sommer R. Nonsurgical transcatheter coil occlusion of patent ductus arteriosus in two dogs using a preformed nitinol snare delivery technique. J Vet Int Med 1998; 12: 182-185.
8. Schneider M, Hildebrandt N, Schweigl T, Schneider I, Hagel KH, Neu H. Transvenous embolization of small patent ductus arteriosus with single detachable coils in dogs. J Vet Int Med 2001; 15: 222-228.
9. Lee S-G, Moon H-S, Choi R, Hyun C. Transvenous occlusion of patent ductus arteriosus using an embolization coil in a Maltese dog. Korean J Vet Res 2007; 47: 461-467.
10. Choi R, Hyun C. Transjugular occlusion of patent ductus arteriosus using an Amplatz canine ductal occluder in a Cocker spaniel dog. Korean J Vet Res 2009; 50: 49-53.
11. Han D, An H, Hyun C. Transarterial coil embolization in two Maltese dogs with patent ductus arteriosus using a mini Cobra-tip angiocatheter. J Vet Clin 2010; 27: 740-745.

동맥관 개존증에 걸린 요크셔테리어종 자견에서 경동맥 경로와 JR Coronary Catheter/Free Push Deployment System을 이용한 색전코일을 이용한 치료증례

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요 약 : 카테터를 이용한 비외과적인 코일 전색술이 동맥관 개존증 치료를 위해 개발되어 있다. 비록 개에서는 대퇴동맥을 이용한 코일 전색술이 가장 보편적으로 이루어지고 있는 시술법이지만, 체중이 2 kg이하인 어린 강아지에서는 카테터 장착을 위한 혈관 확보가 어렵다는 단점이 있다. 따라서 본 증례연구에서는 체중이 적게 나가는 어린 강아지에서 적용이 가능한 경동맥 접근법과 이에 적합한 카테터 장착과 코일 장착방법을 새롭게 시도하여 치료를 하였다. 이 기법을 이용하여 1.25 kg의 요크셔테리어 강아지의 동맥관 개존증을 성공적으로 치료하였다.

주요어 : 코일색전법, JR 혈관카테타, 동맥관 폐쇄, free push deployment system, 동맥관 개존증