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R Sokkalingam
Interventional Medicine Referral Clinic, Department of Veterinary Clinical Medicine, ICAR Center for Advanced Faculty Training in Veterinary Clinical Medine, Madras Veterinary College, Chennai. Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

P Selvaraj
Interventional Medicine Referral Clinic, Department of Veterinary Clinical Medicine, ICAR Center for Advanced Faculty Training in Veterinary Clinical Medine, Madras Veterinary College, Chennai. Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

K Jeyaraja
Interventional Medicine Referral Clinic, Department of Veterinary Clinical Medicine, ICAR Center for Advanced Faculty Training in Veterinary Clinical Medine, Madras Veterinary College, Chennai. Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

R Ramprabhu
Interventional Medicine Referral Clinic, Department of Veterinary Clinical Medicine, ICAR Center for Advanced Faculty Training in Veterinary Clinical Medine, Madras Veterinary College, Chennai. Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

H Pushkinraj
Interventional Medicine Referral Clinic, Department of Veterinary Clinical Medicine, ICAR Center for Advanced Faculty Training in Veterinary Clinical Medine, Madras Veterinary College, Chennai. Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

S Kavitha
Interventional Medicine Referral Clinic, Department of Veterinary Clinical Medicine, ICAR Center for Advanced Faculty Training in Veterinary Clinical Medine, Madras Veterinary College, Chennai. Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

Corresponding Author:
P Selvaraj
Interventional Medicine Referral Clinic, Department of Veterinary Clinical Medicine, ICAR Center for Advanced Faculty Training in Veterinary Clinical Medine, Madras Veterinary College, Chennai. Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

Clinical assessment of 5 Fr and 6 Fr Glidecath catheter for angiographic assessment of dogs with dilated cardiomyopathy

R Sokkalingam, P Selvaraj, K Jeyaraja, R Ramprabhu, H Pushkinraj and S Kavitha

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Abstract
Advanced cardiac diseases in dogs are currently diagnosed and managed with cardiac fluoroscopic assessments and cath-lab based interventions. In India we do not have such advanced facilities for animals. However, dogs with high morbid cardiac diseases/complications are occurring in increasing rates. Novel procedures like trans-catheter interventions needs to be undertaken to manage such cardiac diseases. Clinical Cardiac Catheterizations and Image guided Interventions in Indian dogs and especially indigenous dogs were not undertaken so far. Clinical feasibility assessment studies were are lacking in India.
This study six animals was undertaken to evaluate the utility of 5 Fr and 6 Fr Glidecath Catheters used in Human Medicine, for angiographic assessment in our non - descript dogs and Labrador dogs affected with Dilated cardiomyopathy (DCM). Cardiac fluoroscopy was performed with general purpose C- arm (HF 59R C-Arm with Flat Panel Detector (FPD), which is used for multiple procedures like ortho, spinal/neuro, gastro, urology, etc. The procedure was done under general anesthesia. Cardiac catheterization was done using femoral access and the Glidecath catheter was advanced under C arm-guidance. By injecting the Iohexol contrast, the ventricle chamber perfusion was assessed. The Catheter was further advanced into the entry point of coronary artery and the coronary perfusion was assessed. Themerits and demerits of the procedure were assessed; Pre, intra and post procedural findings and recovery status were presented and discussed.

Keywords: Cardiac catheterizations, angiography, dilated cardiomyopathy

1. Introduction
Arterial catheters are commonly used in both human and veterinary medicine to accurately measure blood pressure and obtain arterial blood samples for blood gas analysis. In terms of blood pressure measurement, arterial catheterization is identified as the gold standard in veterinary practice, and multiple animal studies have demonstrated that arterial catheters are significantly more accurate than various noninvasive blood pressure measurement techniques (Acierno *et al*., 2018) [9].
The discipline of cardiology is directed at care of the heart and vasculature; interventional cardiology is a subspecialty of cardiovascular medicine that affects a therapeutic outcome via minimally invasive catheterization of the heart from peripheral blood vessels or a reduced surgical approach, guided by imaging. These interventions may include balloon dilation of stenotic valves or vessels; coil, particle, or device occlusion of diseased vascular beds or anomalous vessels; stent implantation for narrowed or obstructed lumens; biopsy or extraction of tumors or foreign material in the heart and vasculature; or placement of infusion catheters for delivery of antithrombotics or other drugs (scansen *et al*., 2017) [1]. Pulmonary valve stenosis (PS) is one of the most common congenital heart diseases in dogs (seibert *et al*., 2006) [2].
Pulmonary valve stenosis is inherited in beagles and is commonly seen in terrier breeds and brachycephalic dogs including bulldogs, French bulldogs, and pit bull terriers (Winter *et al*., 2021) [3]. Interventional cardiac procedures, traditionally performed with fluoroscopic guidance impart a risk of radiation exposure to medical personnel and patients, and require

specialized equipment, limiting its availability for many practicing veterinary cardiologists worldwide. To reduce radiation exposure and achieve better visualization of the patent ductus arteriosus (PDA) during transcatheter coil embolization, transesophageal echocardiography (TEE) has been used to guide the procedure in a dog (Pariaut *et al*., 2004) [4]

Coronary arteries perfuse the heart and facilitate nutrient and oxygen delivery to the metabolically active myocardium. Myocardial ischemia related to atherosclerosis and coronary artery obstruction is currently the leading cause of human death and is projected to remain so beyond the year 2030 (Mathers*et al*., 2006) [5]. Myocardial ischemia and infarction related to coronary artery disease also occur in dogs and cats (Driehuys *et al*., 1998) [6] but are more often associated with other underlying diseases and are not believed to commonly impact the morbidity and mortality of domesticated species.

Congenital anomalies of coronary artery anatomy in man are important as a cause of non-arteriosclerotic ischemia and present an increased risk of sudden death in young athletes (Angelini, *et al*., 2007) [7]. Coronary artery anomalies (CAA) in dogs are rarely reported to be of clinical significance, unless in the setting of pulmonary valve stenosis (PS) when the coronary anatomy limits intervention (Fonfara *et al*., 2010) [8]. The aim of this manuscript is to review the coronary arterial circulation of animals, highlighting recognized anomalies and their clinical or comparative anatomical importance

Materials and Methods

The present study was conducted on 12 animals affected with Dilated Cardiomyopathy showing signs of rapid breathing, coughing, weakness, decreased appetite and 2 dogs affected with ascites presented with Madras Veterinary college clinical campus out of 12 dogs, 3 were Doberman dogs and 6 were Labrador dogs and three animals non descript breed are affected with Dilated cardiomyopathy (DCM were taken for the study. The dogs were checked to ascertain that there were no other congenital abnormalities or underlying diseases impacting the cardiac system.

Age, Breed

The animals selected were of above age of 6 were selected and Three male and Three female dogs were selected. There was no breed specificity in the selection of the dogs which were taken for the study.

Diagnostic tests employed

The six dogs were then clinically examined and underwent hematobiochemical analysis, radiography, coagulation test and the results obtained were in the normal range.

Electrocardiogram and Echocardiography

Dilated cardiomyopathy (DCM) is a frequent cause of cardiac disability, congestive heart failure (CHF), and arrhythmic death in dogs. The etiology of DCM is usually idiopathic/genetic, but some causes of a DCM phenotype are reversible (Bonagura *et al* 2022) [11]. Electrocardiogram of the selected animals showed sinus tachycardia and atrial fibrillation and hence they were tested using echocardiography, (Fig- 2) which revealed Dilated cardiomyopathy. Electrocardiography was recorded as per standard protocols (Tilly *et al*., 2009) [12]. (Fig- 1)

Animal Preparation

The dogs were sedated with Glycopyrrollate at the dose rate of 0.02 mg/kg body weight (Dae-KyungHan *et al*., 2009) [10]. The animals were restrained in left lateral recumbency and anesthesia was induced using propofol and maintained in isoflurane inhalant anesthesia as per standard dosage. (Fig- 3)

Fluoroscopical examination techniques

The hair was clipped and shaved and site was prepared aseptically for accessing the femoral artery. The femoral artery was accessed by two methods

1. Cut down technique (n= 4) This minimal invasive technique involves cutting the skin using a sterile BP blade of size 7 and locating the femoral artery in naked eye and accessing it for introducing the catheter by Shabir Bhimji (2016) [13]. (Fig-5)
2. Percutaneous technique (n= 2) This technique involves the palpation of the femoral artery's pulsation and accessing it using a catheter without incising the skin. (Ting *et al*., 2023) [14] (Fig- 6).

Glidecath Catheter

The Glidecath catheter (Cook Company) of sizes 5 Fr and 6 Fr were used for the assessment study, the body weight of the dogs were taken as a standard and 5 Fr size were used for dogs which weighed more than 30 kg and 6 Fr size were used for dogs which weighed less than 30 kg. (Jansen *et al*., 2020) [15]. (Fig – 4).

Fluoroscopy

Cardiac fluoroscopy was performed with general purpose C-arm (HF 59R C-Arm with Flat Panel Detector (FPD), Two-dimensional and color flow Doppler echocardiogram recorded from a modified left cranial - all cardiac parasternal view. This view allows the direct visualization of cardiac chambers Percutaneous access was achieved using a 21-gaugeintroducer need levia the left femoral artery for 3 dogs and 3 dogs required surgical exposure of the left femoral artery because of small diameter of the femoral arteries. In these 3 dogs the left femoral artery was surgically exposed and 5-Fr introducer-dilator was placed into the femoral artery by Bhimji *et al*., (2016) [13].

Contrast agent used

The contrast agent Iohexol, a non ionic, water soluble contrast agent was used as required, an average volume of 20 ml were required for each dog, the guide wire was used to locate the cardiac chamber and the contrast dye iohexol was injected and the image was visualized using the C-arm. By Molen *et al*., (2024) [16].

Parameters studied

The following parameters were studied based on the 5 Fr and 6 Fr Glidecath catheter intervention and the procedural values were analysed in the 6 dogs.

1. Coronary artery perfusion
2. Ventricular perfusion
3. Post operative complication

Coronary artery perfusion

The coronary artery perfusion were studied well in both 5 Fr and 6 Fr Glidecath catheter and the visualized images obtained helped in studying both left and right branches of the coronary artery, indicating the effectiveness of using the Glidecath catheters for dogs. (Ting *et al*.,2023) [14]. (Fig-7)

Ventricular perfusion

The ventricular perfusion were studied using the Glidecath catheters, the iohexal contrast agent was infused and the ventricular perfusion was visualized and the left ventricular chamber was visualized and the contrast agent delivery required was effectively supplied by the 5 Fr and 6 Fr catheters. This opened up the possibility of conducting advanced interventional procedure in the left ventricle.
(ware *et al*.,2022) [17]. (Fig-8)

Post operative complications

The most common post operative complication endured was the formation of hematoma in 25% of the animals that underwent percutaneous technique (n=2). Seroma in 25% of the animals that underwent percutaneous technique (n=2). There was no hematoma formation in the cut down technique since necessary management techniques could be employed to avoid hematoma formation. (N.L. LeBlanc *et al*. 2019) [18] (Fig-9).

Fig 1: Electrocardiogram

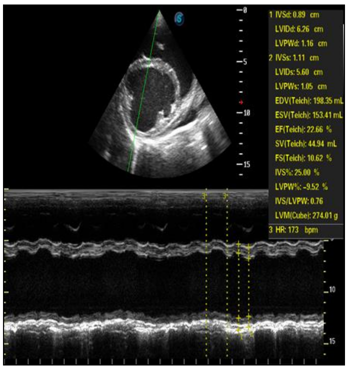

Fig 2: Echo-cardiographical evaluation

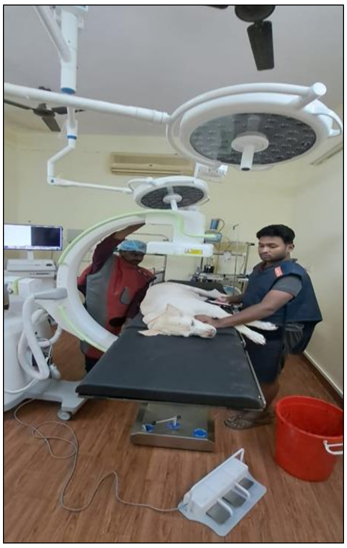

Fig 3: Restraining of animals

Fig 4: Glidecath catheters

Fig 5: Cutdown technique

Fig 6: Percutaneous technique

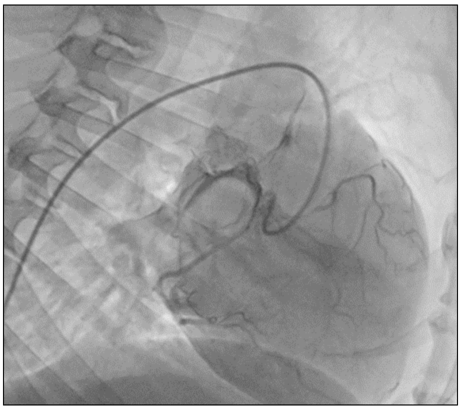

Fig 7: Coronary artery

Fig 8: Ventricle perfusion

Fig 9: Heamatoma complication

Conclusion

Thus the study revealed that 5 Fr and 6 Fr Glidecath catheters could be used for flouroscopical studies in breed dogs and non descript dogs efficiently. Further, the scale of 30 kgs for determining the size of Glidecath catheter can be standardized and used in mongrel and Indian native breed dogs. Further, the Glidecath catheters are equally efficient when compared to the left jerkin and right jerkin catheters used for fluoroscopy studies.

Conflict of Interest

Not available

Financial Support

Not available

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